

# SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: BEN SACKY Examiner #: 73489 Date: 11/17/04  
 Art Unit: 1626 Phone Number 302-0704 Serial Number: 101645429  
 Mail Box and Bldg/Room Location: REM 5B31 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Two-Stage process for the hydrogenation of Maleic acid to  
 Inventors (please provide full names): Robert Heppel et al.

Earliest Priority Filing Date: 8/29/00

\*For Sequence Searches Only\* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

A process for the hydrogenation of Maleic acid to gamma-butyrolactone, 1,4-butanediol and tetrahydrofuran comprising applying a feed stream of Maleic acid into a first hydrogenation zone in the presence of a catalyst to produce Succinic acid then to 2<sup>nd</sup> hydrogenation zone in the presence of Hydrogen and catalyst to produce the product stream of gamma-butyrolactone, 1,4-butanediol and tetrahydrofuran.

Remarks

<b>STAFF USE ONLY</b>		Type of Search	Vendors and cost where applicable
Searcher:	<u>Noble</u>	NA Sequence (#)	STN <u>623</u>
Searcher Phone #:		AA Sequence (#)	Dialog
Searcher Location:		Structure (#)	Questel/Orbit
Date Searcher Picked Up:		Bibliographic	Dr.Link
Date Completed:	<u>Nov 18 2004</u>	Litigation	Lexis/Nexis
Searcher Prep & Review Time:	<u>30</u>	Fulltext	Sequence Systems
Clerical Prep Time:		Patent Family	WWW/Internet
Online Time:	<u>60</u>	Other	Other (specify)



# STIC Search Report

## Biotech-Chem Library

STIC Database Tracking Number: 138055

**TO:** Ben Sackey  
**Location:** 5b31/5c18  
**Art Unit:** 1626  
**Thursday, November 18, 2004**  
**Case Serial Number:** 10/645426

**From:** Noble Jarrell  
**Location:** Biotech-Chem Library  
**Rem 1B71**  
**Phone:** 272-2556  
**Noble.jarrell@uspto.gov**

### Search Notes

=> d his

(FILE 'HOME' ENTERED AT 11:06:28 ON 18 NOV 2004)

FILE 'HCAPLUS' ENTERED AT 11:21:04 ON 18 NOV 2004  
L1 1 US20040039213/PN }

FILE 'REGISTRY' ENTERED AT 11:21:17 ON 18 NOV 2004

FILE 'HCAPLUS' ENTERED AT 11:21:23 ON 18 NOV 2004  
L2 TRA L1 1- RN : 15 TERMS

FILE 'REGISTRY' ENTERED AT 11:21:23 ON 18 NOV 2004  
L3 15 SEA L2

FILE 'WPIX' ENTERED AT 11:21:28 ON 18 NOV 2004

L4 1-US20040039213/PN }

=> b hcap

FILE 'HCAPLUS' ENTERED AT 11:21:40 ON 18 NOV 2004  
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.  
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.  
COPYRIGHT (C) 2004 AMERICAN CHEMICAL SOCIETY (ACS)

Copyright of the articles to which records in this database refer is held by the publishers listed in the PUBLISHER (PB) field (available for records published or updated in Chemical Abstracts after December 26, 1996), unless otherwise indicated in the original publications. The CA Lexicon is the copyrighted intellectual property of the American Chemical Society and is provided to assist you in searching databases on STN. Any dissemination, distribution, copying, or storing of this information, without the prior written consent of CAS, is strictly prohibited.

FILE COVERS 1907 - 18 Nov 2004 VOL 141 ISS 21  
FILE LAST UPDATED: 17 Nov 2004 (20041117/ED)

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> d all li }

L1 ANSWER 1 OF 1 HCAPLUS COPYRIGHT 2004 ACS on STN  
AN 2002:171834 HCAPLUS  
DN 136:217182  
ED Entered STN: 08 Mar 2002  
TI Two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone  
IN Hepfer, Robert P.; Miller, Craig T.; Attig, Thomas G.; Norenberg, Gregory A.; Budge, John R.  
PA The Standard Oil Company, USA  
SO PCT Int. Appl., 14 pp.  
CODEN: PIXXD2  
DT Patent  
LA English  
IC ICM C07C051-36  
      ICS C07C055-10; C07C029-149; C07C031-20  
CC 35-2 (Chemistry of Synthetic High Polymers)  
Section cross-reference(s): 23, 27, 48  
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002018316	A2	20020307	WO 2001-US26765	20010827
	WO 2002018316	A3	20020620		
	W:	AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM			
	RW:	GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG			
	AU 2001085320	A5	20020313	AU 2001-85320	20010827

EP 1313693	A2	20030528	EP 2001-964473	20010827
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR				
JP 2004507516	T2	20040311	JP 2002-523434	20010827
US 2004039213	A1	20040226	US 2003-645429	20030821 <--
PRAI US 2000-651526	A	20000829		
WO 2001-US26765	W	20010827		

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2002018316	ICM	C07C051-36
	ICS	C07C055-10; C07C029-149; C07C031-20
JP 2004507516	FTERM	C037/EA02; 4C037/EA03; 4H006/AA02; 4H006/AC11; 4H006/AC41; 4H006/AC46; 4H006/BA16; 4H006/BA23; 4H006/BA24; 4H006/BA25; 4H006/BA26; 4H006/BA55; 4H006/BC10; 4H006/BC11; 4H006/BD70; 4H006/BE20; 4H006/FE11; 4H039/CA19; 4H039/CA60; 4H039/CB10; 4H039/CB40
US 2004039213	ECLA	C07C029/149

AB At least one of gamma-butyrolactone, 1,4-butanediol, and THF are prepared in a process comprising: (A) a first hydrogenation zone and a second hydrogenation zone connected in series; (B) supplying to the first hydrogenation zone a feedstream comprising maleic acid; (C) reacting in the first hydrogenation zone, the maleic acid feedstock and hydrogen in contact with a catalyst to produce a reaction product comprising succinic acid; (D) supplying to the second hydrogenation zone, the reaction product of the first hydrogenation zone; (E) reacting in the second hydrogenation zone, the reaction product from the first hydrogenation zone and hydrogen in contact with a catalyst to produce a product stream comprising at least one of gamma-butyrolactone, 1,4-butanediol, and THF, where the temperature of the feedstream comprising maleic acid and the temperature of the first hydrogenation zone are controlled such that the temperature of maleic acid in the feedstream and the first hydrogenation zone does not exceed about 130.degree..

ST butanediol manuf two stage hydrogenation maleic acid; dihydroxybutane manuf two stage hydrogenation maleic acid; THF manuf two stage hydrogenation maleic acid

IT Hydrogenation catalysts  
(Pt-Group metals in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT Platinum-group metals  
RL: CAT (Catalyst use); USES (Uses)  
(catalysts for the hydrogenation of maleic acid into 1,4-butanediol)

IT Hydrogenation  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-15-5, Rhenium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses  
RL: CAT (Catalyst use); USES (Uses)  
(catalysts in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT 7440-44-0, Carbon, uses  
RL: CAT (Catalyst use); USES (Uses)  
(support; catalysts in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT 110-16-7P, Maleic acid, preparation  
RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT 96-48-0P, .gamma.-Butyrolactone  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or)

IT 110-15-6P, Succinic acid, preparation  
RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone)

IT 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6D, Succinic acid, esters 110-16-7D, Maleic acid, esters 1333-74-0, Hydrogen, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)

(two-stage process for the hydrogenation of maleic acid into  
1,4-butanediol or THF or gamma-butyrolactone)  
IT 109-99-9P, Thf, preparation  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT  
(Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into  
1,4-butanediol or gamma-butyrolactone or)  
IT 110-63-4P, 1,4-Butanediol, preparation  
RL: IMF (Industrial manufacture); PREP (Preparation)  
(two-stage process for the hydrogenation of maleic acid into  
gamma-butyrolactone or THF or)

=> b reg  
FILE 'REGISTRY' ENTERED AT 11:21:48 ON 18 NOV 2004  
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.  
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.  
COPYRIGHT (C) 2004 American Chemical Society (ACS)

Property values tagged with IC are from the ZIC/VINITI data file  
provided by InfoChem.

STRUCTURE FILE UPDATES: 17 NOV 2004 HIGHEST RN 783276-57-3  
DICTIONARY FILE UPDATES: 17 NOV 2004 HIGHEST RN 783276-57-3

TSCA INFORMATION NOW CURRENT THROUGH MAY 21, 2004

Please note that search-term pricing does apply when  
conducting SmartSELECT searches.

Crossover limits have been increased. See HELP CROSSOVER for details.

Experimental and calculated property data are now available. For more  
information enter HELP PROP at an arrow prompt in the file or refer  
to the file summary sheet on the web at:  
<http://www.cas.org/ONLINE/DBSS/registryss.html>

=> d ide-13-tot  
L3 ANSWER 1 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
RN 7440-44-0 REGISTRY  
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)  
OTHER NAMES:  
CN 1262R97  
CN 207A  
CN 207A (carbon)  
CN 207E3  
CN 20SPD  
CN 2C98  
CN 3GX  
CN 4GCX  
CN 4GM  
CN 606R97  
CN AC 01  
CN AC 01 (adsorbent)  
CN AC 100  
CN AC 100 (adsorbent)  
CN AC 40  
CN AC 40 (adsorbent)  
CN Acticarbon 25K  
CN Acticarbon ENO  
CN Acticarbon TK  
CN Actitex CS 1501  
CN Activated carbon  
CN AG 2  
CN AG 2 (catalyst support)  
CN AG 2-4  
CN AG 3  
CN AG 3 (adsorbent)  
CN AG 5  
CN AG 5 (adsorbent)  
CN AG 95  
CN AG 95 (carbon)  
CN AG-M  
CN AG-M (carbon)  
CN AG-OV 1

CN AGN 1  
CN AGN 1 (carbon)  
CN AGN 2  
CN AGN 2 (carbon)  
CN AGN 3  
CN AGS 3  
CN AGS 4  
CN AGS 4 (adsorbent)  
CN AK  
CN AK (adsorbent)  
CN Amoco PX 21  
CN Anthrasorb  
CN APB 10C  
CN AR 2  
CN AR 2 (carbon)  
CN AR 3  
CN AR 3 (carbon)

ADDITIONAL NAMES NOT AVAILABLE IN THIS FORMAT - Use FCN, FIDE, or ALL for DISPLAY

DR 12789-22-9, 130960-03-1, 67167-41-3, 114680-00-1, 37196-29-5, 137322-21-5,  
76416-61-0, 82600-58-6, 83138-28-7, 26837-67-2, 39422-04-3, 39434-34-9,  
116788-82-0, 208519-32-8, 208728-20-5

MF C  
CI COM  
LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, AQUIRE, BIOBUSINESS, BIOSIS,  
BIOTECHNO, CA, CABAB, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN,  
CHEMCATS, CHEMLIST, CIN, CSCHEM, CSNB, DDFU, DETHERM\*, DIOGENES, DIPPR\*,  
DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, HSDB\*,  
IFICDB, IFIPAT, IFIUDB, IMSCOSEARCH, IPA, MEDLINE, MRCK\*, MSDS-OHS,  
NIOSHTIC, PDLCOM\*, PIRA, PROMT, RTECS\*, TOXCENTER, TULSA, ULIDAT,  
USPAT2, USPATFULL, VTB  
(\*File contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
(\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent;  
Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC  
(Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role  
in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
(Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
study); CMBI (Combinatorial study); FORM (Formation, nonpreparative);  
MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC  
(Proceess); PRP (Properties); RACT (Reactant or reagent); USES (Uses);  
NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
(Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
PRP (Properties); RACT (Reactant or reagent); USES (Uses)

C

286676 REFERENCES IN FILE CA (1907 TO DATE)  
12778 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
287166 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
18 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 2 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
RN 7440-22-4 REGISTRY  
CN Silver (8CI, 9CI) (CA INDEX NAME)  
OTHER NAMES:  
CN 11000SP  
CN 1520D  
CN 15ED001  
CN 15ED173  
CN 3050HD  
CN 3200HD  
CN 6142D  
CN 7000C

CN 7000ID  
 CN AA 0101  
 CN Ag 1T  
 CN Ag 3010  
 CN Ag-C-GS  
 CN AG-CO  
 CN Ag-E 100  
 CN Ag-E 350  
 CN AgC 156I  
 CN AgC 209  
 CN AgC 2190  
 CN AgC 239  
 CN AgC 251  
 CN AgC 401  
 CN AgC-A  
 CN AgC-D  
 CN AGF 20S  
 CN Algaedyn  
 CN Argentum  
 CN Astroflake 5  
 CN AX 10C  
 CN AY 6010  
 CN AY 6080  
 CN C 0083P  
 CN C 200  
 CN C 200 (metal)  
 CN C.I. 77820  
 CN Carey Lea silver  
 CN Colloidal silver  
 CN CW 7100  
 CN D 25  
 CN D 25 (metal)  
 CN Degussa 67  
 CN Degussa 80  
 CN Dotite XA 208  
 CN Du Pont 4943  
 CN E 174  
 CN E 20  
 CN EA 0008  
 CN EA 295  
 CN ED 6036  
 CN EG 20

ADDITIONAL NAMES NOT AVAILABLE IN THIS FORMAT - Use FCN, FIDE, or ALL for  
 DISPLAY

DR 12553-68-3, 87354-45-8, 87370-84-1  
 MF Ag  
 CI COM  
 LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, AQUIRE, BIOSIS, BIOTECHNO, CA,  
 CABA, CANCERLIT, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX,  
 CHEMLIST, CHEMSAFE, CIN, CSCHEM, CSNB, DDFU, DETHERM\*, DIOGENES, DIPPR\*,  
 DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, HSDB\*,  
 IFICDB, IFIPAT, IFIUDB, IPA, MEDLINE, MRCK\*, MSDS-OHS, NIOSHTIC, PIRA,  
 PROMT, RTECS\*, TOXCENTER, ULIDAT, USPAT2, USPATFULL, VETU, VTB  
 (\*File contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent;  
 Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
 CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role  
 in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
 study); CMBI (Combinatorial study); FORM (Formation, nonpreparative);  
 MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC  
 (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses);  
 NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
 study); BIOL (Biological study); CMBI (Combinatorial study); FORM  
 (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence);  
 PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or

reagent); USES (Uses)

Ag

\*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

157051 REFERENCES IN FILE CA (1907 TO DATE)  
 5141 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 157290 REFERENCES IN FILE CAPLUS (1907 TO DATE)

L3 ANSWER 3 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 7440-18-8 REGISTRY  
 CN Ruthenium (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN Ru-Al  
 CN Ruthenium black  
 CN Ruthenium element  
 DR 57572-01-7, 100041-48-3  
 MF Ru  
 CI COM  
 LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, AQUIRE, BIOBUSINESS, BIOSIS,  
 BIOTECHNO, CA, CABA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN,  
 CHEMCATS, CHEMINFORMRX, CHEMLIST, CIN, CSCHEM, CSNB, DDFU, DETHERM\*,  
 DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, IFICDB,  
 IFIPAT, IFIUDB, IPA, MEDLINE, MRCK\*, MSDS-OHS, NIOSHTIC, PIRA, PROMT,  
 TOXCENTER, TULSA, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)  
 DT.CA Cplus document type: Book; Conference; Dissertation; Journal; Patent;  
 Preprint; Report  
 RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
 CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role  
 in record)  
 RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)  
 RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
 study); CMBI (Combinatorial study); FORM (Formation, nonpreparative);  
 MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC  
 (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses);  
 NORL (No role in record)  
 RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)

Ru

32446 REFERENCES IN FILE CA (1907 TO DATE)  
 4459 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 32513 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 1 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 4 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 7440-16-6 REGISTRY  
 CN Rhodium (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN Rhodium black  
 CN Rhodium-103  
 DR 24546-24-5, 100041-37-0  
 MF Rh  
 CI COM  
 LC STN Files: AGRICOLA, ANABSTR, BIOBUSINESS, BIOSIS, BIOTECHNO, CA, CABA,  
 CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX,  
 CHEMLIST, CIN, CSCHEM, CSNB, DDFU, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2,  
 ENCOMPPAT, ENCOMPPAT2, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA, MEDLINE,  
 MRCK\*, MSDS-OHS, NIOSHTIC, PDLCOM\*, PIRA, PROMT, RTECS\*, TOXCENTER,

TULSA, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent; Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

Rh

35892 REFERENCES IN FILE CA (1907 TO DATE)  
 3713 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 35940 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 1 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 5 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 7440-15-5 REGISTRY  
 CN Rhenium (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN NSC 600662  
 CN Rhenium element  
 MF Re  
 CI COM  
 LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, BIOBUSINESS, BIOSIS, BIOTECHNO, CA, CANCERLIT, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX, CHEMLIST, CIN, CSCHEM, DDFU, DETHERM\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, IFICDB, IFIPAT, IFIUDB, MEDLINE, MRCK\*, MSDS-OHS, NIOSHTIC, PIRA, PROMT, RTECS\*, TOXCENTER, TULSA, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent; Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

Re

\*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

16707 REFERENCES IN FILE CA (1907 TO DATE)  
 1411 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 16723 REFERENCES IN FILE CAPLUS (1907 TO DATE)

L3 ANSWER 6 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 7440-06-4 REGISTRY  
 CN Platinum (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN C.I. 77795  
 CN Furuuchi 8105  
 CN Liquid Bright Platinum  
 CN Platinum black  
 CN Platinum element  
 CN PR 0  
 CN TP 1  
 CN TP 1 (metal)  
 CN TPT 200  
 CN TR 706  
 DR 21547-63-7  
 MF Pt  
 CI COM  
 LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, BIOBUSINESS, BIOSIS, BIOTECHNO, CA, CABA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX, CHEMLIST, CHEMSAFE, CIN, CSCHEM, CSNB, DDFU, DETHERM\*, DIOGENES, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA, MEDLINE, MRCK\*, MSDS-OHS, NIOSHTIC, PIRA, PROMT, RTECS\*, TOXCENTER, TULSA, ULIDAT, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*

(\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA Caplus document type: Book; Conference; Dissertation; Journal; Patent; Preprint; Report  
 RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); CMPI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)  
 RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); CMPI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)  
 RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMPI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)  
 RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); CMPI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

Pt

\*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

125224 REFERENCES IN FILE CA (1907 TO DATE)  
 6412 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 125419 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 1 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 7 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 7440-05-3 REGISTRY  
 CN Palladium (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN E 1010/W  
 CN MPP 030  
 CN MPP 050

CN MPP 080  
 CN P 50  
 CN P 50 (metal)  
 CN Palladex 600  
 CN Palladium black  
 CN Palladium element  
 CN SFP 1001P  
 MF Pd  
 CI COM  
 LC STN Files: AGRICOLA, ANABSTR, BIOBUSINESS, BIOSIS, BIOTECHNO, CA,  
 CANCERLIT, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX,  
 CHEMLIST, CIN, CSCHEM, CSNB, DDFU, DETHERM\*, DRUGU, EMBASE, ENCOMPLIT,  
 ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA,  
 MEDLINE, MRCK\*, MSDS-OHS, NIOSHTIC, PIRA, PROMT, RTECS\*, TOXCENTER,  
 TULSA, ULIDAT, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent;  
 Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
 CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role  
 in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
 study); CMBI (Combinatorial study); FORM (Formation, nonpreparative);  
 MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC  
 (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses);  
 NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
 study); BIOL (Biological study); CMBI (Combinatorial study); FORM  
 (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence);  
 PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or  
 reagent); USES (Uses)

Pd

## \*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

83942 REFERENCES IN FILE CA (1907 TO DATE)  
 6090 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 84079 REFERENCES IN FILE CAPLUS (1907 TO DATE)

L3 ANSWER 8 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 1333-74-0 RÉGISTRY  
 CN Hydrogen (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN Dihydrogen  
 CN Hydrogen (H2)  
 CN Hydrogen molecule  
 CN Mol. hydrogen  
 CN Molecular hydrogen  
 CN Orthohydrogen  
 CN Parahydrogen  
 CN Protium  
 DR 725200-57-7  
 MF H2  
 CI COM  
 LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, BIOBUSINESS, BIOSIS, BIOTECHNO,  
 CA, CABA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS,  
 CHEMINFORMRX, CHEMLIST, CHEMSAFE, CIN, CSCHEM, CSNB, DDFU, DETHERM\*,  
 DIOGENES, DIPPR\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT,  
 ENCOMPPAT2, HSDB\*, IFICDB, IFIPAT, IFIUDB, IMSCOSEARCH, IPA, MEDLINE,  
 MRCK\*, MSDS-OHS, NIOSHTIC, PDLCOM\*, PIRA, PROMT, RTECS\*, SPECINFO,  
 TOXCENTER, TULSA, ULIDAT, USPAT2, USPATFULL  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent; Preprint; Report  
 RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)  
 RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)  
 RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)  
 RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

H-H

291812 REFERENCES IN FILE CA (1907 TO DATE)  
 3597 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 292175 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 1 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 9 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN

RN 110-63-4 REGISTRY

CN 1,4-Butanediol (8CI, 9CI) (CA INDEX NAME)

OTHER NAMES:

CN 1,4-Butylene glycol

CN 1,4-Dihydroxybutane

CN 1,4-Tetramethylene glycol

CN Butylene glycol

CN Dabco DBO

CN Diol 14B

CN NSC 406696

CN Polycure D

CN Sucol B

CN Tetramethylene 1,4-diol

CN Tetramethylene glycol

CN Vibracure A 250

FS 3D CONCORD

DR 732189-03-6

MF C4 H10 O2

CI COM

LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOBUSINESS, BIOSIS, BIOTECHNO, CA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX, CHEMLIST, CHEMSAFE, CIN, CSHEM, CSNB, DETHERM\*, DIPPR\*, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, GMELIN\*, HODOC\*, HSDB\*, IFICDB, IFIUDB, IPA, MEDLINE, MSDS-OHS, NAPRALERT, NIOSHTIC, PDLCOM\*, PIRA, PROMT, PS, RTECS\*, SPECINFO, TOXCENTER, TULSA, ULIDAT, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*

(\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Conference; Dissertation; Journal; Patent; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM

(Formation, nonpreparative); MSC (Miscellaneous); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

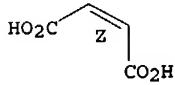
HO—(CH<sub>2</sub>)<sub>4</sub>—OH

\*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

8334 REFERENCES IN FILE CA (1907 TO DATE)  
 2352 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 8346 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 9 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 10 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 110-16-7 REGISTRY  
 CN 2-Butenedioic acid (2Z)- (9CI) (CA INDEX NAME)  
 OTHER CA INDEX NAMES:  
 CN 2-Butenedioic acid (Z)-  
 CN Maleic acid (8CI)  
 OTHER NAMES:  
 CN 2-Butenedioic acid, (Z)-  
 CN cis-1,2-Ethylenedicarboxylic acid  
 CN cis-2-Butenedioic acid  
 CN cis-Butenedioic acid  
 CN Maleinic acid  
 CN Malezid CM  
 CN Scotchbond Multipurpose Etchant  
 CN Toxicilic acid  
 FS STEREOSEARCH  
 MF C4 H4 O4  
 CI COM  
 LC STN Files: AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOSIS,  
 BIOTECHNO, CA, CABA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN,  
 CHEMCATS, CHEMINFORMRX, CHEMLIST, CIN, CSCHEM, CSNB, DDFU, DETHERM\*,  
 DIPPR\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2,  
 GMELIN\*, HODOC\*, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA, MEDLINE, MRCK\*,  
 MSDS-OHS, NAPRALERT, NIOSHTIC, PDLCOM\*, PIRA, PROMT, PS, RTECS\*,  
 SPECINFO, SYNTHLINE, TOXCENTER, TULSA, USPAT2, USPATFULL  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)  
 DT.CA Caplus document type: Book; Conference; Dissertation; Journal; Patent;  
 Preprint; Report  
 RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
 FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU  
 (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT  
 (Reactant or reagent); USES (Uses); NORL (No role in record)  
 RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)  
 RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
 study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU  
 (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT  
 (Reactant or reagent); USES (Uses); NORL (No role in record)  
 RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)

Double bond geometry as shown.



\*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

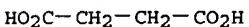
13381 REFERENCES IN FILE CA (1907 TO DATE)  
 3219 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA

13399 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 5 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 11 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 110-15-6 REGISTRY  
 CN Butanedioic acid (9CI) (CA INDEX NAME)  
 OTHER CA INDEX NAMES:  
 CN Succinic acid (8CI)  
 OTHER NAMES:  
 CN 1,2-Ethanedicarboxylic acid  
 CN 1,4-Butanedioic acid  
 CN A 12084  
 CN Amber acid  
 CN Asuccin  
 CN Dihydrofumaric acid  
 CN Katasuccin  
 CN NSC 106449  
 CN NSC 25949  
 CN Wormwood acid  
 FS 3D CONCORD  
 DR 623158-99-6  
 MF C4 H6 O4  
 CI COM  
 LC STN Files: AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOBUSINESS, BIOSIS,  
 BIOTECHNO, CA, CABA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN,  
 CHEMCATS, CHEMINFORMRX, CHEMLIST, CIN, CSCHEM, DDFU, DETHERM\*, DIOGENES,  
 DIPPR\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2,  
 GMELIN\*, HODOC\*, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA, MEDLINE, MRCK\*,  
 MSDS-OHS, NAPRALERT, NIOSHTIC, PDLCOM\*, PIRA, PROMT, RTECS\*, SPECINFO,  
 SYNTHLINE, TOXCENTER, TULSA, ULIDAT, USPAT2, USPATFULL, VETU, VTB  
 (\*FILE contains numerically searchable property data)

Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA CAplus document type: Book; Conference; Dissertation; Journal; Patent;  
 Preprint; Report  
 RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
 CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role  
 in record)  
 RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)  
 RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
 study); CMBI (Combinatorial study); FORM (Formation, nonpreparative);  
 MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC  
 (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses);  
 NORL (No role in record)  
 RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses)



\*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

24646 REFERENCES IN FILE CA (1907 TO DATE)  
 2612 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 24673 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 9 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 12 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 109-99-9 REGISTRY  
 CN Furan, tetrahydro- (7CI, 8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN Butane .alpha..delta.-oxide  
 CN Butane, 1,4-epoxy-  
 CN Cyclotetramethylene oxide  
 CN Furanidine  
 CN NSC 57858  
 CN Oxacyclopentane

CN Oxolane  
 CN Tetrahydrofuran  
 CN Tetramethylene oxide  
 CN THF  
 FS 3D CONCORD  
 DR 77392-70-2  
 MF C4 H8 O  
 CI COM  
 LC STN Files: ADISNEWS, AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOBUSINESS,  
 BIOSIS, BIOTECHNO, CA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN,  
 CHEMCATS, CHEMINFORMRX, CHEMLIST, CHEMSAFE, CIN, CSCHEM, CSNB, DDFU,  
 DETHERM\*, DIPPR\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT,  
 ENCOMPPAT2, GMELIN\*, HODOC\*, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA,  
 MEDLINE, MRCK\*, MSDS-OHS, NAPRALERT, NIOSHTIC, PDLCOM\*, PIRA, PROMT,  
 RTECS\*, SPECINFO, SYNTHLINE, TOXCENTER, TULSA, ULIDAT, USPAT2,  
 USPATFULL, VETU, VTB  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA Caplus document type: Book; Conference; Dissertation; Journal; Patent;  
 Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study);  
 CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process);  
 PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role  
 in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); PREP  
 (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or  
 reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological  
 study); CMBI (Combinatorial study); FORM (Formation, nonpreparative);  
 MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC  
 (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses);  
 NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical  
 study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC  
 (Miscellaneous); PREP (Preparation); PROC (Process); PRP (Properties);  
 RACT (Reactant or reagent); USES (Uses)



## \*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

21564 REFERENCES IN FILE CA (1907 TO DATE)  
 800 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 21628 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 1 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 13 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 108-31-6 REGISTRY  
 CN 2,5-Furandione (9CI) (CA INDEX NAME)  
 OTHER CA INDEX NAMES:  
 CN Maleic anhydride (8CI)  
 OTHER NAMES:  
 CN BM 10  
 CN cis-Butenedioic anhydride  
 CN Crystal Man  
 CN Crystal Man AB  
 CN Dihydro-2,5-dioxofuran  
 CN HG 3-993-76  
 CN Maleic acid anhydride  
 CN Nourymix MA 901  
 CN NSC 137651  
 CN NSC 137652  
 CN NSC 137653  
 CN NSC 9568  
 CN Toxilic anhydride  
 FS 3D CONCORD  
 DR 184288-31-1  
 MF C4 H2 O3

CI COM  
 LC STN Files: AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOBUSINESS, BIOSIS,  
 BIOTECHNO, CA, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS,  
 CHEMINFORMRX, CHEMLIST, CHEMSAFE, CIN, CSCHEM, CSNB, DDFU, DETHERM\*,  
 DIPPR\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2,  
 GMELIN\*, HODOC\*, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA, MRCK\*, MSDS-OHS,  
 NIOSHTIC, PDLCOM\*, PIRA, PROMT, PS, RTECS\*, SPECINFO, SYNTHLINE,  
 TOXCENTER, TULSA, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA Caplus document type: Book; Conference; Dissertation; Journal; Patent; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)



## \*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

31833 REFERENCES IN FILE CA (1907 TO DATE)  
 14409 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 31895 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 13 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

L3 ANSWER 14 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 108-30-5 REGISTRY  
 CN 2,5-Furandione, dihydro- (9CI) (CA INDEX NAME)  
 OTHER CA INDEX NAMES:  
 CN Succinic anhydride (8CI)  
 OTHER NAMES:  
 CN 2,5-Diketotetrahydrofuran  
 CN Butanedioic anhydride  
 CN Dihydro-2,5-furandione  
 CN NSC 8518  
 CN Rikacid SA  
 CN Succinic acid anhydride  
 CN Succinyl anhydride  
 CN Succinyl oxide  
 CN Tetrahydro-2,5-dioxofuran  
 CN Tetrahydro-2,5-furandione  
 FS 3D CONCORD  
 MF C4 H4 O3  
 CI COM  
 LC STN Files: AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOBUSINESS, BIOSIS,  
 BIOTECHNO, CA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS,  
 CHEMINFORMRX, CHEMLIST, CIN, CSCHEM, CSNB, DDFU, DETHERM\*, DIPPR\*,  
 DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPPAT, ENCOMPPAT2, GMELIN\*,  
 HODOC\*, HSDB\*, IFICDB, IFIPAT, IFIUDB, MEDLINE, MRCK\*, MSDS-OHS,  
 NIOSHTIC, PIRA, PROMT, PS, RTECS\*, SPECINFO, SYNTHLINE, TOXCENTER,  
 TULSA, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)

DT.CA Caplus document type: Conference; Dissertation; Journal; Patent; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.P Roles for non-specific derivatives from patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); CMBI (Combinatorial study); FORM (Formation, nonpreparative); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)



## \*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

9401 REFERENCES IN FILE CA (1907 TO DATE)  
 2849 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 9419 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 59 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

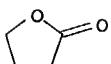
L3 ANSWER 15 OF 15 REGISTRY COPYRIGHT 2004 ACS on STN  
 RN 96-48-0 REGISTRY  
 CN 2(3H)-Furanone, dihydro- (8CI, 9CI) (CA INDEX NAME)  
 OTHER NAMES:  
 CN .gamma.-BL  
 CN .gamma.-Butalactone  
 CN .gamma.-Butyrolactone  
 CN .gamma.-Butyryllactone  
 CN .gamma.-Hydroxybutyric acid lactone  
 CN 1,4-Butanolide  
 CN 1-Oxacyclopentan-2-one  
 CN 2,3,4,5-Tetrahydro-2-furanone  
 CN 2-Oxolanone  
 CN 2-Oxotetrahydrofuran  
 CN 4,5-Dihydro-2(3H)-furanone  
 CN 4-Butanolide  
 CN 4-Deoxytetroanic acid  
 CN 4-Hydroxybutanoic acid lactone  
 CN 4-Hydroxybutyric acid lactone  
 CN Butanoic acid, 4-hydroxy-, .gamma.-lactone  
 CN Butyric acid lactone  
 CN Butyrolactone  
 CN Dihydro-2(3H)-furanone  
 CN NIH 10540  
 CN NSC 4592  
 CN Paint Clean G  
 CN Tetrahydro-2-furanone  
 FS 3D CONCORD  
 DR 187997-16-6  
 MF C4 H6 O2  
 CI COM  
 LC STN Files: ADISINSIGHT, ADISNEWS, AGRICOLA, ANABSTR, AQUIRE, BEILSTEIN\*, BIOBUSINESS, BIOSIS, BIOTECHNO, CA, CANCERLIT, CAOLD, CAPLUS, CASREACT, CBNB, CEN, CHEMCATS, CHEMINFORMRX, CHEMLIST, CHEMSAFE, CIN, CSChem, CSNB, DDFU, DETHERM\*, DIOGENES, DIPPR\*, DRUGU, EMBASE, ENCOMPLIT, ENCOMPLIT2, ENCOMPAT, ENCOMPAT2, GMELIN\*, HODOC\*, HSDB\*, IFICDB, IFIPAT, IFIUDB, IPA, MEDLINE, MRCK\*, MSDS-OHS, NAPRALERT, NIOSHTIC, PDLCOM\*, PIRA, PROMT, RTECS\*, SPECINFO, SYNTHLINE, TOXCENTER, TULSA, ULIDAT, USPAT2, USPATFULL, VTB  
 (\*File contains numerically searchable property data)  
 Other Sources: DSL\*\*, EINECS\*\*, TSCA\*\*  
 (\*\*Enter CHEMLIST File for up-to-date regulatory information)  
 DT.CA CAplus document type: Conference; Dissertation; Journal; Patent; Preprint; Report

RL.P Roles from patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.P Roles for non-specific derivatives from patents: BIOL (Biological study); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)

RL.NP Roles from non-patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses); NORL (No role in record)

RLD.NP Roles for non-specific derivatives from non-patents: ANST (Analytical study); BIOL (Biological study); FORM (Formation, nonpreparative); MSC (Miscellaneous); OCCU (Occurrence); PREP (Preparation); PROC (Process); PRP (Properties); RACT (Reactant or reagent); USES (Uses)



## \*\*PROPERTY DATA AVAILABLE IN THE 'PROP' FORMAT\*\*

8341 REFERENCES IN FILE CA (1907 TO DATE)  
 243 REFERENCES TO NON-SPECIFIC DERIVATIVES IN FILE CA  
 8365 REFERENCES IN FILE CAPLUS (1907 TO DATE)  
 37 REFERENCES IN FILE CAOLD (PRIOR TO 1967)

=> b wpix

[FILE 'WPIX'] ENTERED AT 11:21:57 ON 18 NOV 2004  
 COPYRIGHT (C) 2004 THE THOMSON CORPORATION

FILE LAST UPDATED: 17 NOV 2004 <20041117/UP>  
 MOST RECENT DERWENT UPDATE: 200474 <200474/DW>  
 DERWENT WORLD PATENTS INDEX SUBSCRIBER FILE, COVERS 1963 TO DATE

>>> FOR A COPY OF THE DERWENT WORLD PATENTS INDEX STN USER GUIDE,  
 PLEASE VISIT:  
[<<<](http://www.stn-international.de/training_center/patents/stn_guide.pdf)

>>> FOR DETAILS OF THE PATENTS COVERED IN CURRENT UPDATES, SEE  
<http://thomsonderwent.com/coverage/latestupdates/> <<<

>>> FOR INFORMATION ON ALL DERWENT WORLD PATENTS INDEX USER  
 GUIDES, PLEASE VISIT:  
<http://thomsonderwent.com/support/userguides/> <<<

>>> NEW! FAST-ALERTING ACCESS TO NEWLY-PUBLISHED PATENT  
 DOCUMENTATION NOW AVAILABLE IN DERWENT WORLD PATENTS INDEX  
 FIRST VIEW - FILE WPIFV.  
 FOR FURTHER DETAILS: [<<<](http://www.thomsonderwent.com/dwpifv)

>>> NEW DISPLAY FORMAT HITSTR ADDED ALLOWING DISPLAY OF  
 HIT STRUCTURES WITHIN THE BIBLIOGRAPHIC DOCUMENT <<<

>>> SMILES and ISOSMILES strings are no longer available as  
 Derwent Chemistry Resource display fields <<<

=> d all 14 tot

L4 ANSWER 1 OF 1 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN  
 AN 2002-393725 [42] WPIX  
 DNC C2002-110692  
 TI Production of butyrolactone, 1,4-butanediol and/or tetrahydrofuran comprising catalytic hydrogenation of maleic acid to succinic acid and catalytic hydrogenation of succinic acid at low temperatures.  
 DC A41 E13 E17  
 IN ATTIG, T G; BUDGE, J R; HEPFER, R P; MILLER, C T; NORENBERG, G A  
 PA (STAHL) STANDARD OIL CO OHIO; (ATTI-I) ATTIG T G; (BUDG-I) BUDGE J R;  
 (HEPF-I) HEPFER R P; (MILL-I) MILLER C T; (NORE-I) NORENBERG G A

CYC 98  
 PI WO 2002018316 A2 20020307 (200242)\* EN 14 C07C051-36  
 RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ  
 NL OA PT SD SE SL SZ TR TZ UG ZW  
 W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK  
 DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR  
 KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PH PL PT RO  
 RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW  
 AU 2001085320 A 20020313 (200249) C07C051-36  
 EP 1313693 A2 20030528 (200336) EN C07C051-36  
 R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT  
 RO SE SI TR  
 KR 2003027086 A 20030403 (200353) C07C029-149  
 CN 1447786 A 20031008 (200403) C07C051-36  
 US-2004039213 A1 20040226 (200416) C07D307-027 <--  
 JP 2004507516 W 20040311 (200419) 28 C07C029-149  
 ADT WO 2002018316 A2 WO 2001-US26765 20010827; AU 2001085320 A AU 2001-85320  
 20010827; EP 1313693 A2 EP 2001-964473 20010827, WO 2001-US26765 20010827;  
 KR 2003027086 A KR 2003-702790 20030226; CN 1447786 A CN 2001-814530  
 20010827; US 2004039213 A1 Cont of US 2000-651526 20000829, US 2003-645429  
 20030821; JP 2004507516 W WO 2001-US26765 20010827, JP 2002-523434  
 20010827  
 FDT AU 2001085320 A Based on WO 2002018316; EP 1313693 A2 Based on WO  
 2002018316; JP 2004507516 W Based on WO 2002018316  
 PRAI US 2000-651526 20000829; US 2003-645429 20030821  
 IC ICM C07C029-149; C07C051-36; C07D307-02  
 ICS C07C027-04; C07C031-20; C07C055-10; C07D307-33; C07D323-02  
 AB WO 200218316 A UPAB: 20020704  
 NOVELTY - Production of gamma -butyrolactone, 1,4-butanediol and/or  
 tetrahydrofuran comprises reacting maleic acid with H<sub>2</sub> and catalyst in  
 first hydrogenation zone (1HZ) to produce succinic acid; and reacting  
 succinic acid with H<sub>2</sub> and catalyst in second hydrogenation zone.  
 Temperature of maleic acid feedstream and 1HZ are controlled to below 130  
 deg. C.  
 DETAILED DESCRIPTION - Production of gamma -butyrolactone,  
 1,4-butanediol and/or tetrahydrofuran (THF) comprises:  
 (a) connecting a first hydrogenation zone (1HZ) and a second  
 hydrogenation zone (2HZ) in series;  
 (b) supplying a maleic acid feedstream to 1HZ;  
 (c) reacting the maleic acid feedstock with H<sub>2</sub> in contact with a  
 catalyst to produce succinic acid;  
 (d) supplying the succinic acid to 2HZ;  
 (e) reacting the succinic acid with H<sub>2</sub> in contact with a catalyst to  
 produce a product stream.  
 Temperature of maleic acid feedstream and 1HZ are controlled to below  
 130 deg. C.  
 USE - Product 1,4-butanediol is a commercial commodity with many  
 uses, e.g. production of polybutylene terephthalate and reaction-injection  
 molded (RIM) urethanes.  
 ADVANTAGE - Temperature control minimizes the corrosive effects of  
 maleic acid, prolongs reactor life and improves overall process economics.  
 Dwg.0/0  
 FS CPI  
 FA AB; DCN  
 MC CPI: A01-E14; E07-A01; E07-A02C; E10-E04C2; N02-E; N06-F; N07-B

=> b home  
 FILE 'HOME' ENTERED AT 11:22:01 ON 18 NOV 2004

=>

=> d his

(FILE 'HOME' ENTERED AT 11:06:28 ON 18 NOV 2004)  
DEL HIS Y

FILE 'HCAPLUS' ENTERED AT 11:21:04 ON 18 NOV 2004  
L1 1 US20040039213/PN

FILE 'REGISTRY' ENTERED AT 11:21:17 ON 18 NOV 2004

FILE 'HCAPLUS' ENTERED AT 11:21:23 ON 18 NOV 2004  
L2 TRA L1 1- RN : 15 TERMS

FILE 'REGISTRY' ENTERED AT 11:21:23 ON 18 NOV 2004  
L3 15 SEA L2

FILE 'WPIX' ENTERED AT 11:21:28 ON 18 NOV 2004  
L4 1 US20040039213/PN

FILE 'REGISTRY' ENTERED AT 11:32:16 ON 18 NOV 2004  
L5 1 110-16-7  
L6 124 C4H404 AND MALEIC (1A) ACID NOT ((PMS OR MAN OR IDS)/CI OR UNSP  
L7 1 96-48-0  
L8 11 C4H6O2 AND BUTYROLACTONE NOT ((PMS OR MAN OR IDS)/CI OR UNSPECI  
L9 5 L8 AND FURANONE  
L10 6 L8 NOT L9  
L11 1 109-99-9  
L12 5 C4H8O AND THF NOT ((PMS OR MAN OR IDS)/CI OR UNSPECIFIED OR COM  
L13 4 L12 NOT (MXS/CI OR MIXT)  
L14 1 110-63-4  
L15 1 L14 AND 1(1A)4 (1A) BUTANEDIOL NOT ((PMS OR MAN OR IDS)/CI OR U  
L16 1 L14 AND (1 AND 4 AND BUTANEDIOL) NOT ((PMS OR MAN OR IDS)/CI OR  
L17 1 110-15-6  
L18 114 C4H6O4 AND SUCCINIC (1A) ACID NOT ((PMS OR MAN OR IDS)/CI OR UN

FILE 'HCAPLUS' ENTERED AT 11:47:12 ON 18 NOV 2004  
E HYDROGENATION/CT  
E E3+ALL  
L19 48309 HYDROGENATION+NT/CT  
E HYDROGEN CATALYST/CT  
E HYDROGENATION CATALYST/CT  
E E4+ALL  
L20 38368 HYDROGENATION CATALYSTS+NT/CT  
QUE L7 OR L9 OR FURANONE (2A) (DIHYDRO OR TETRAHYDRO) OR GAMMA  
QUE OXOLANONE OR OXOTETRAHYDROFURAN OR DEOXYTETONIC (1A) ACID O  
L23 129997 L11 OR L13 OR THF OR FURAN (1A) TETRAHYDRO OR BUTANE (2A) EPOXY  
L24 30297 L14 OR L16 OR 1 (1A) 4 (1A) (BUTANEDIOL OR (TETRAMETHYLENE OR B  
L25 43710 L5-6 OR (BUTENEDIOIC OR MALEI? OR ETHYLENEDICARBOXYLIC OR TOXIL  
L26 47309 L17-18 OR (SUCCINIC OR ETHANEDICARBOXYLIC OR BUTANEDIOIC OR DIH  
L27 318 L19 AND L25  
E HEPFER R/AU  
L28 2 E4-5  
E MILLER C/AU  
L29 160 E3, E50  
E MILLER CRAIG/AU  
L30 27 E3, E15-17  
E NORENBERG G/AU  
L31 1 E4  
E ATTIG T/AU  
L32 35 E4-6  
E BUDGE J/AU  
L33 40 E3, E5-7  
L34 13774 (STANDARD (1A) OIL)/CS, PA  
L35 5 L27 AND L28-34  
L36 313 L27 NOT L35  
L37 105 L36 AND L26  
L38 37 L37 AND L21-24  
L39 23 L38 AND L20  
L40 QUE (PY<=2000 OR AY<=2000 OR PRY<=2000 OR PD<20000829 OR AD<200  
L41 18 L39 AND L40  
L42 4179 L25 (L) RACT+NT/RL  
L43 5939 L26 (L) (PREP+NT OR RACT+NT) /RL  
L44 14137 L21-24 (L) PREP+NT/RL  
L45 134 L42 AND L19  
L46 54 L45 AND L43  
L47 24 L46 AND L44

L48 20 L47 AND L20  
 L49 16 L48 AND L40  
 L50 23 L41 OR L49

=> d all 135 tot)

L35 ANSWER 1 OF 5 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 2002:171834 HCAPLUS  
 DN 136:217182  
 ED Entered STN: 08 Mar 2002  
 TI Two-stage process for the hydrogenation of maleic acid  
 into 1,4-butanediol or THF or gamma-butyrolactone  
 IN Hepfer, Robert P.; Miller, Craig T.; Attig,  
 Thomas G.; Norenberg, Gregory A.; Budge, John R.  
 PA The Standard Oil Company, USA  
 SO PCT Int. Appl., 14 pp.  
 CODEN: PIXXD2  
 DT Patent  
 LA English  
 IC ICM C07C051-36  
 ICS C07C055-10; C07C029-149; C07C031-20  
 CC 35-2 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 23, 27, 48

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002018316	A2	20020307	WO 2001-US26765	20010827
	WO 2002018316	A3	20020620		
		W:	AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG		
AU	2001085320	A5	20020313	AU 2001-85320	20010827
EP	1313693	A2	20030528	EP 2001-964473	20010827
		R:	AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR		
JP	2004507516	T2	20040311	JP 2002-523434	20010827
US	2004039213	A1	20040226	US 2003-645429	20030821
PRAI	US 2000-651526	A	20000829		
	WO 2001-US26765	W	20010827		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2002018316	ICM	C07C051-36
	ICS	C07C055-10; C07C029-149; C07C031-20
JP 2004507516	FTERM	4C037/EA02; 4C037/EA03; 4H006/AA02; 4H006/AC11; 4H006/AC41; 4H006/AC46; 4H006/BA16; 4H006/BA23; 4H006/BA24; 4H006/BA25; 4H006/BA26; 4H006/BA55; 4H006/BC10; 4H006/BC11; 4H006/BD70; 4H006/BE20; 4H006/FE11; 4H039/CA19; 4H039/CA60; 4H039/CB10; 4H039/CB40

US 2004039213 ECLA C07C029/149

AB At least one of gamma-butyrolactone, 1,4-butanediol, and THF are prepared in a process comprising: (A) a first hydrogenation zone and a second hydrogenation zone connected in series; (B) supplying to the first hydrogenation zone a feedstream comprising maleic acid ; (C) reacting in the first hydrogenation zone, the maleic acid feedstock and hydrogen in contact with a catalyst to produce a reaction product comprising succinic acid; (D) supplying to the second hydrogenation zone, the reaction product of the first hydrogenationzone; (E) reacting in the second hydrogenation zone, the reaction product from the first hydrogenationzone and hydrogen in contact with a catalyst to produce a product stream comprising at least one of gamma-butyrolactone, 1,4-butanediol, and THF, where the temperature of the feedstream comprising maleic acid and the temperature of the first hydrogenation zone are controlled such that the temperature of maleic acid in the feedstream and the first hydrogenation zone does not exceed about 130.degree..

ST butanediol manuf two stage hydrogenation maleic acid; dihydroxybutane manuf two stage hydrogenation maleic acid; THF manuf two stage hydrogenation maleic

acid; butyrolactone manuf two stage hydrogenation maleic acid  
IT Hydrogenation catalysts  
(Pt-Group metals in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)  
IT Platinum-group metals  
RL: CAT (Catalyst use); USES (Uses)  
(catalysts for the hydrogenation of maleic acid into 1,4-butanediol)  
IT Hydrogenation  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)  
IT 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-15-5, Rhenium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses  
RL: CAT (Catalyst use); USES (Uses)  
(catalysts in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)  
IT 7440-44-0, Carbon, uses  
RL: CAT (Catalyst use); USES (Uses)  
(support; catalysts in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)  
IT 110-16-7B, Maleic acid, preparation  
RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)  
IT 96-48-0P, .gamma.-Butyrolactone  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or)  
IT 110-15-6B, Succinic acid, preparation  
RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone)  
IT 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6D, Succinic acid, esters 110-16-7D, Maleic acid, esters 1333-74-0, Hydrogen, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone)  
IT 109-99-9P, Thf, preparation  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or gamma-butyrolactone or)  
IT 110-63-4P, 1,4-Butanediol, preparation  
RL: IMF (Industrial manufacture); PREP (Preparation)  
(two-stage process for the hydrogenation of maleic acid into gamma-butyrolactone or THF or)

L35 ANSWER 2 OF 5 HCPLUS COPYRIGHT 2004 ACS on STN  
AN 2001:128171 HCPLUS  
DN 134:164831  
ED Entered STN: 21 Feb 2001  
TI Process for hydrogenation of maleic acid to 1,4-butanediol by using oxidized carbon-supported catalysts  
IN Budge, John R.; Attig, Thomas G.; Dubbert, Robert A.  
PA The Standard Oil Company, USA  
SO Jpn. Kokai Tokkyo Koho, 30 pp.  
CODEN: JKXXAF

DT Patent  
LA Japanese  
IC ICM B01J023-66  
ICS B01J023-89; C07B061-00; C07C029-149; C07C031-20; C07D307-08  
CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)  
Section cross-reference(s): 23, 67  
FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2001046871	A2	20010220	JP 1999-219971	19990803
AU 772779	B2	20040506	AU 1999-43498	19990809
AU 9943498	A1	20010215		
PRAI JP 1999-219971	A	19990803		

## CLASS

PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES

JP 2001046871 ICM B01J023-66  
 ICS B01J023-89; C07B061-00; C07C029-149; C07C031-20;  
 C07D307-08

AB Maleic acid, maleic anhydride and other hydrogenatable precursors are catalytically hydrogenated into 1,4-butanediol and THF by using a hydrogenation catalyst comprising palladium, silver, rhenium, and .gtoreq.1 aluminum, and/or cobalt on a carbon support, wherein the catalyst is prepared by (i) oxidizing the carbon support with an oxidizing agent; (ii) impregnating the treated support in .gtoreq.1 impregnation step comprising contacting the support with a source of palladium, silver, rhenium, and .gtoreq.1 aluminum, and/or cobalt, resp.; (iii) drying the impregnated support to remove solvent after each impregnation; and (iv) heating the dried support. The use of the catalyst in the process give a higher yield of i,4-butanediol with minimal formation of .gamma.-butyrolactone byproduct.

ST butanediol THF prepn maleic anhydride hydrogenation; carbon support oxidized hydrogenation catalyst; palladium silver rhenium carbon supported catalyst; aluminum cobalt carbon supported catalyst

IT Catalyst supports

Hydrogenation

Hydrogenation catalysts

(process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)

IT 7440-44-0, Norit RX 1.5 Extra, uses  
 RL: CAT (Catalyst use); USES (Uses)

(activated, support; process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)

IT 7429-90-5, Aluminum, uses 7440-48-4, Cobalt, uses 7761-88-8, Silver nitrate, uses 7782-61-8, Ferric nitrate nonahydrate 10102-05-3, Palladium nitrate 13768-11-1, Perrhenic acid

RL: CAT (Catalyst use); USES (Uses)  
 (process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)

IT 109-99-9P, THF, preparation 110-63-4P, 1,4-Butanediol, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)  
 (process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)

IT 96-48-0, .gamma.-Butyrolactone 106-65-0, Dimethyl succinate 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-15-6D, Succinic acid, esters

110-16-7, Maleic acid, reactions

110-16-7D, Maleic acid, esters

110-17-8, Fumaric acid, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
 (process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)

L35 ANSWER 3 OF 5 HCPLUS COPYRIGHT 2004 ACS on STN

AN 1999:670143 HCPLUS

DN 131:272328

ED Entered STN: 21 Oct 1999

TI Process and catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol

IN Budge, John Raymond; Attig, Thomas George; Dubbert, Robert Allen

PA The Standard Oil Company, USA

SO U.S., 7 pp., Cont.-in-part of U.S. Ser. No. 781,945, abandoned.

CODEN: USXXAM

DT Patent

LA English

IC ICM C07D307-02

NCL 549508000

CC 35-2 (Chemistry of Synthetic High Polymers)

Section cross-reference(s): 23, 67

FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5969164	A	19991019	US 1998-56193	19980406
	SG 74602	A1	20000822	SG 1997-3830	19971022
	AU 9743631	A1	19980625	AU 1997-43631	19971029
	AU 720496	B2	20000601		
	AT 262376	E	20040415	AT 1997-310014	19971211

JP 10192709	A2	19980728	JP 1997-347597	19971217
CN 1185993	A	19980701	CN 1997-108787	19971219
CN 1094791	B	20021127		
TW 415938	B	20001221	TW 1997-86119385	19971219
EP 1077080	A1	20010221	EP 1999-306525	19990818
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO				
SG 84543	A1	20011120	SG 1999-4399	19990908
PRAI US 1996-781945	B2	19961220		

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
------------	-------	------------------------------------

US 5969164	ICM	C07D307-02
	NCL	549508000
AB	A catalyst for the hydrogenation of maleic acid, maleic anhydride, or other hydrogenatable precursors (e.g., di-Me succinate) to 1,4-butanediol in high yield and selectivity is described which comprises palladium, silver, rhenium, and at least one of iron, aluminum, cobalt, or their mixts. all on a carbon support. The hydrogenation catalyst is prepared by first oxidizing the carbon support by contacting it with an oxidizing agent (e.g., nitric acid), followed by impregnating the oxidized support with a source of the catalytic metals, drying the impregnated support, and heating the dried support at 100-350.degree. under reducing conditions.	
ST	butanediol manuf maleic acid hydrogenation; hydrogenation catalyst maleic anhydride prepn butanediol	
IT	Oxidation (of a carbon support in the preparation of a hydrogenation catalyst for the conversion of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	Hydrogenation (of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	Reduction (of metal-impregnated and dried carbon support in the preparation of catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	Hydrogenation catalysts (palladium and silver and rhenium and at least one of iron and/or aluminum and/or cobalt and/or their mixts. all on a carbon support for the conversion of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	7429-90-5, Aluminum, uses 7439-89-6, Iron, uses 7440-05-3, Palladium, uses 7440-15-5, Rhenium, uses 7440-22-4, Silver, uses 7440-48-4, Cobalt, uses RL: CAT (Catalyst use); USES (Uses) (catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	7601-90-3, Perchloric acid, reactions 7681-52-9, Sodium hypochlorite 7697-37-2, Nitric acid, reactions 7722-84-1, Hydrogen peroxide, reactions 7727-54-0, Ammonium persulfate RL: RCT (Reactant); RACT (Reactant or reagent) (in the preparation of catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	109-99-9P, Thf, preparation 110-63-4P, 1,4-Butanediol, preparation RL: IMF (Industrial manufacture); PREP (Preparation) (process and catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	96-48-0, .gamma.-Butyrolactone 106-65-0, Dimethyl succinate 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-15-6D, Succinic acid, esters 110-16-7, Maleic acid, reactions 110-16-7D, Maleic acid, esters 110-17-8, Fumaric acid, reactions RL: RCT (Reactant); RACT (Reactant or reagent) (process and catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)	
IT	7440-44-0, Carbon, reactions RL: CAT (Catalyst use); RCT (Reactant); RACT (Reactant or reagent); USES (Uses) (support; catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)	

RE.CNT 1 THERE ARE 1 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

(1) Kitson; US 4985572 1991 HCPLUS

L35 ANSWER 4 OF 5 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1999:355604 HCPLUS  
 DN 130:352770  
 ED Entered STN: 10 Jun 1999  
 TI Process and catalysts for the hydrogenation of maleic acid or its derivatives into 1,4-butanediol  
 IN Attig, Thomas George; Budge, John Raymond; Dubbert, Robert Allen  
 PA The Standard Oil Company, USA  
 SO Eur. Pat. Appl., 8 pp.  
 CODEN: EPXXDW  
 DT Patent  
 LA English  
 IC ICM C07C029-17  
 ICS C07C029-149  
 CC 35-2 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 23, 48, 67  
 FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	EP 919530	A1	19990602	EP 1998-309711	19981126
	EP 919530	B1	20020213		
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO				
	US 6486367	B1	20021126	US 1997-980542	19971201
	AU 9891414	A1	19990617	AU 1998-91414	19981109
	AU 756102	B2	20030102		
	SG 74671	A1	20000822	SG 1998-4651	19981111
	ES 2172865	T3	20021001	ES 1998-309711	19981126
	CN 1229072	A	19990922	CN 1998-125255	19981130
	CN 1110472	B	20030604		
	MX 9810028	A	20000131	MX 1998-10028	19981130
	JP 11240846	A2	19990907	JP 1998-342228	19981201
	TW 401317	B	20000811	TW 1998-87119806	19990224
	ZA 9904944	A	20000207	ZA 1999-4944	19990802
PRAI	US 1997-980542	A	19971201		

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
EP 919530	ICM	C07C029-17
	ICS	C07C029-149
EP 919530	ECLA	C07C029/17F
US 6486367	ECLA	C07C029/17F

AB 1,4-Butanediol is prepared in high yield and selectivity by the hydrogenation of maleic acid and/or its hydrogenatable precursors (e.g., gamma.-butyrolactone, fumaric acid, succinic acid, etc.) in the presence of a platinum-group metal catalyst (e.g., Pd and Re); the production and yield of 1,4-butanediol is enhanced by the addition of 20-160 ppm of iron, in the form of an iron compound (e.g., iron acetate), to the hydrogenatable precursor feed.

ST butanediol manuf maleic acid hydrogenation;  
 hydrogenation catalyst iron additive manuf butanediol

IT Platinum-group metals

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT Hydrogenation

(of maleic acid or its derivs. into 1,4-butanediol)

IT Hydrogenation catalysts

(platinum-group metals with iron compds. for the conversion of maleic acid or its derivs. into 1,4-butanediol)

IT 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 7440-15-5, Rhenium, uses 7440-22-4, Silver, uses

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with platinum-group metals and iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 2140-52-5, Iron acetate 7439-89-6, Iron, uses 14451-00-4, Iron fumarate 31516-56-0, Maleic acid iron salt 38781-07-6, Butanoic acid, iron salt 43212-87-9, Iron succinate 72535-95-6, Iron propionate

RL: CAT (Catalyst use); USES (Uses)

(catalysts with platinum-group metals for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 110-63-4P, 1,4-Butanediol, preparation  
 RL: IMF (Industrial manufacture); PREP (Preparation)  
 (process and catalysts for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 96-48-0, .gamma.-Butyrolactone 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-15-6D, Succinic acid, di(C1-8 alkyl) esters 110-16-7, Maleic acid, reactions 110-16-7D, Maleic acid, di(C1-8 alkyl) esters 110-17-8, Fumaric acid, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (process and catalysts for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 7440-44-0, Carbon, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (support; catalysts with platinum-group metals and iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

RE.CNT 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

- (1) Attig, T; US 4827001 A 1989 HCPLUS
- (2) Hoechst; GB 1551741 A 1979 HCPLUS
- (3) Kitson, M; US 5149680 A 1992 HCPLUS

L35 ANSWER 5 OF 5 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1998:1355 HCPLUS  
 DN 128:63169  
 ED Entered STN: 02 Jan 1998  
 TI Catalysts for the hydrogenation of aqueous solutions of maleic acid and its derivatives into 1,4-butanediol  
 IN Pedersen, S. Erik; Frye, John G., Jr.; Attig, Thomas G.;  
 Budge, John R.  
 PA Standard Oil Co., USA  
 SO U.S., 7 pp.  
 CODEN: USXXAM  
 DT Patent  
 LA English  
 IC ICM C07C029-149  
 ICS C07D307-08  
 NCL 568864000  
 CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)  
 Section cross-reference(s): 23, 48, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5698749	A	19971216	US 1995-524195	19950906
	EP 881203	A1	19981202	EP 1997-303664	19970530
	EP 881203	B1	20010919		
	R: AT, BE, DE, ES, FR, GB, IT, NL				
	AT 205820	E	20011015	AT 1997-303664	19970530
	ES 2164992	T3	20020301	ES 1997-303664	19970530
	TW 419456	B	20010121	TW 1997-86114367	19971002
PRAI	US 1995-524195	A	19950906		
	EP 1997-303664	A	19970530		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
US 5698749	ICM	C07C029-149
	ICS	C07D307-08
	NCL	568864000

AB Maleic acid, maleic anhydride and its other hydrogenatable derivs. (e.g., fumaric acid, succinic acid, etc.) are catalytically hydrogenated into 1,4-butanediol with reduced formation of THF and .gamma.-butyrolactone when the hydrogenation catalyst comprises .gtoreq.1 noble metal of Group VIII and .gtoreq.1 of Re, W, or Mo on a carbon support, which support has been contacted with an oxidizing agent prior to deposition of the metals. These catalysts are prepared by: (i) oxidizing the carbon support by contacting it with an oxidizing agent (e.g., HNO<sub>3</sub>, H<sub>2</sub>O<sub>2</sub>, HClO<sub>4</sub>, etc.); (ii) impregnating the treated support in .gtoreq.1 impregnation step(s); (iii) drying; and (iv.) heating the dried, impregnated support under reducing conditions.

ST butanol prepn maleic anhydride hydrogenation; catalyst hydrogenation prepn  
 IT Hydrogenation catalysts  
 (Group VIII elements and Re and/or W and/or Mo on an oxidant-treated

carbon support for the conversion of aqueous solns. of maleic acid and its derivs. to 1,4-butanediol)

IT Group VIII elements  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. to 1,4-butanediol)

IT Hydrogenation  
 (of aqueous solns. of maleic acid and its derivs. to 1,4-butanediol)

IT 7439-98-7, Molybdenum, uses 7440-15-5, Rhenium, uses 7440-33-7, Tungsten, uses 7440-44-0, Carbon, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (process and catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. into 1,4-butanediol)

IT 110-63-4P, 1,4-Butanediol, preparation  
 RL: IMF (Industrial manufacture); SPN (Synthetic preparation); PREP (Preparation)  
 (process and catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. into 1,4-butanediol)

IT 96-48-0, .gamma.-Butyrolactone 106-65-0, Dimethyl succinate 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-16-7, Maleic acid, reactions 110-17-8, Fumaric acid, reactions 7601-90-3, Perchloric acid, reactions 7681-52-9, Sodium hypochlorite 7697-37-2, Nitric acid, reactions 7722-84-1, Hydrogen peroxide, reactions 7727-54-0, Ammonium persulfate  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (process and catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. into 1,4-butanediol)

=> d all 150 tot

L50 ANSWER 1 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 2002:171834 HCPLUS  
 DN 136:217182  
 ED Entered STN: 08 Mar 2002  
 TI Two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone  
 IN Hepfer, Robert P.; Miller, Craig T.; Attig, Thomas G.; Norenberg, Gregory A.; Budge, John R.  
 PA The Standard Oil Company, USA  
 SO PCT Int. Appl., 14 pp.  
 CODEN: PIXXD2  
 DT Patent  
 LA English  
 IC ICM C07C051-36  
 ICS C07C055-10; C07C029-149; C07C031-20  
 CC 35-2 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 23, 27, 48

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002018316	A2	20020307	WO 2001-US26765	20010827 <--
	WO 2002018316	A3	20020620		
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM				
	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
AU	2001085320	A5	20020313	AU 2001-85320	20010827 <--
EP	1313693	A2	20030528	EP 2001-964473	20010827 <--
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR				
JP	2004507516	T2	20040311	JP 2002-523434	20010827 <--
US	2004039213	A1	20040226	US 2003-645429	20030821 <--
PRAI	US 2000-651526	A	20000829 <--		
	WO 2001-US26765	W	20010827		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2002018316	ICM	C07C051-36

ICS C07C055-10; C07C029-149; C07C031-20  
 JP 2004507516 FTERM 4C037/EA02; 4C037/EA03; 4H006/AA02; 4H006/AC11;  
 4H006/AC41; 4H006/AC46; 4H006/BA16; 4H006/BA23;  
 4H006/BA24; 4H006/BA25; 4H006/BA26; 4H006/BA55;  
 4H006/BC10; 4H006/BC11; 4H006/BD70; 4H006/BE20;  
 4H006/FE11; 4H039/CA19; 4H039/CA60; 4H039/CB10;  
 4H039/CB40

&lt;--

&lt;--

US 2004039213 ECLA C07C029/149

AB At least one of gamma-butyrolactone, 1,4-butanediol, and THF are prepared in a process comprising: (A) a first hydrogenation zone and a second hydrogenation zone connected in series; (B) supplying to the first hydrogenation zone a feedstream comprising maleic acid; (C) reacting in the first hydrogenation zone, the maleic acid feedstock and hydrogen in contact with a catalyst to produce a reaction product comprising succinic acid; (D) supplying to the second hydrogenation zone, the reaction product of the first hydrogenation zone; (E) reacting in the second hydrogenation zone, the reaction product from the first hydrogenation zone and hydrogen in contact with a catalyst to produce a product stream comprising at least one of gamma-butyrolactone, 1,4-butanediol, and THF, where the temperature of the feedstream comprising maleic acid and the temperature of the first hydrogenation zone are controlled such that the temperature of maleic acid in the feedstream and the first hydrogenation zone does not exceed about 130.degree..

ST butanediol manuf two stage hydrogenation maleic acid; dihydroxybutane manuf two stage hydrogenation maleic acid; THF manuf two stage hydrogenation maleic acid

## IT Hydrogenation catalysts

(Pt-Group metals in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

## IT Platinum-group metals

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts for the hydrogenation of maleic acid into 1,4-butanediol)

## IT Hydrogenation

(two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-15-5, Rhenium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalysts in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

IT 7440-44-0, Carbon, uses-

RL: CAT (Catalyst use); USES (Uses)  
 (support; catalysts in a two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

## IT 110-16-7P, Maleic acid, preparation

RL: PNU (Preparation, unclassified); RCT (Reactant);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (two-stage process for the hydrogenation of maleic acid into 1,4-butanediol)

## IT 96-48-0P, .gamma.-Butyrolactone

RL: IMF (Industrial manufacture); RCT (Reactant);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or)

## IT 110-15-6P, Succinic acid, preparation

RL: PNU (Preparation, unclassified); RCT (Reactant);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone)

IT 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6D, Succinic acid, esters 110-16-7D, Maleic acid, esters 1333-74-0, Hydrogen, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
 (two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or THF or gamma-butyrolactone)

## IT 109-99-9P, Thf, preparation

RL: IMF (Industrial manufacture); RCT (Reactant);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (two-stage process for the hydrogenation of maleic acid into 1,4-butanediol or gamma-butyrolactone or)

IT 110-63-4P, 1,4-Butanediol,  
preparation  
RL: IMF (Industrial manufacture); PREP (Preparation)  
(two-stage process for the hydrogenation of maleic acid into  
gamma-butyrolactone or THF or)

L50 ANSWER 2 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
AN 2001:713278 HCAPLUS  
DN 135:242663  
ED Entered STN: 28 Sep 2001  
TI Hydrogenative method for the production of alcohols from carbonyl  
compounds using rhenium-containing, activated carbon-supported catalysts  
IN Fischer, Rolf-Hartmuth; Pinkos, Rolf; Schunk, Stephan Andreas;  
Wulff-Doering, Joachim  
PA Basf Aktiengesellschaft, Germany  
SO PCT Int. Appl., 11 pp.  
CODEN: PIXXD2

DT Patent  
LA German  
IC ICM C07C029-00  
CC 35-2 (Chemistry of Synthetic High Polymers)  
Section cross-reference(s): 21, 67

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2001070657	A2	20010927	WO 2001-EP3374	20010323 <--
WO 2001070657	A3	20011220		
W: CN, JP, KR, US				
RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR				
DE 10014646	A1	20010927	DE 2000-10014646	20000324 <--
EP 1272270	A2	20030108	EP 2001-936136	20010323 <--
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, FI, CY, TR				
JP 2003528064	T2	20030924	JP 2001-568870	20010323 <--
US 2003050516	A1	20030313	US 2002-239409	20020923
US 6765118	B2	20040720		
PRAI DE 2000-10014646	A	20000324 <--		
WO 2001-EP3374	W	20010323		

## CLASS

PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES

WO 2001070657	ICM	C07C029-00	
DE 10014646	ECLA	B01J023/36; B01J023/889H; C07C029/149	<--
AB	Alcs. (e.g., 1,4-butanediol) are prepared in high yield and selectivity by the catalytic hydrogenation of carbonyl compds. (e.g., maleic acid) using a catalyst containing 0.01-50% rhenium and 0-20% (based upon total catalyst weight) of Zn, Cu, Ag, Au, Ni, Fe, Cr, or V supported on oxidatively (e.g., HNO <sub>3</sub> ) pretreated activated carbon.		

ST butanediol prepn maleic acid hydrogenation; alc manuf  
carbonyl compd hydrogenation; catalyst hydrogenation carbonyl compd manuf  
alc

IT Hydrogenation catalysts  
(Re/C for the conversion of carbonyl compds. into alcs.)

IT Carboxylic acids, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(dicarboxylic; hydrogenative method for the production of alcs. from  
carbonyl compds. using rhenium-containing, activated carbon-supported  
catalysts)

IT Carboxylic acids, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(esters; hydrogenative method for the production of alcs. from carbonyl  
compds. using rhenium-containing, activated carbon-supported catalysts)

IT Alcohols, preparation  
Glycols, preparation  
RL: IMF (Industrial manufacture); SPN (Synthetic preparation); PREP  
(Preparation)  
(hydrogenative method for the production of alcs. from carbonyl compds.  
using rhenium-containing, activated carbon-supported catalysts)

IT Aldehydes, reactions  
Anhydrides  
Carboxyl compounds (organic), reactions  
Carboxylic acids, reactions  
Lactones  
RL: RCT (Reactant); RACT (Reactant or reagent)

(hydrogenative method for the production of alcs. from carbonyl compds. using rhenium-containing, activated carbon-supported catalysts)

- IT **Hydrogenation**  
     (of carbonyl compds. into alcs.)
- IT 7440-44-0, Activated carbon, uses  
     RL: CAT (Catalyst use); USES (Uses)  
         (activated, support; hydrogenative method for the production of alcs. from carbonyl compds. using rhenium-containing, activated carbon-supported catalysts)
- IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-15-5, Rhenium, uses 7440-22-4, Silver, uses 7440-47-3, Chromium, uses 7440-50-8, Copper, uses 7440-57-5, Gold, uses 7440-62-2, Vanadium, uses 7440-66-6, Zinc, uses  
     RL: CAT (Catalyst use); USES (Uses)  
         (hydrogenative method for the production of alcs. from carbonyl compds. using rhenium-containing, activated carbon-supported catalysts)
- IT 110-63-4P, 1,4-Butanediol,  
     preparation 629-11-8P, 1,6-Hexanediol 118562-73-5P  
     RL: IMF (Industrial manufacture); SPN (Synthetic preparation); PREP (Preparation)  
         (hydrogenative method for the production of alcs. from carbonyl compds. using rhenium-containing, activated carbon-supported catalysts)
- IT 96-48-0, .gamma.-Butyrolactone 108-31-6,  
     Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-16-7, Maleic acid , reactions 110-17-8, Fumaric acid, reactions 502-44-3, Caprolactone 1191-25-9, 6=Hydroxycaproic acid 178804-38-1  
     RL: RCT (Reactant); RACT (Reactant or reagent)  
         (hydrogenative method for the production of alcs. from carbonyl compds. using rhenium-containing, activated carbon-supported catalysts)

L50 ANSWER 3 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 2001:657477 HCAPLUS  
 DN 135:211419  
 ED Entered STN: 07 Sep 2001  
 TI Procedure for the production of alcohols by the hydrogenation of carbonyl compounds using rhenium-and-platinum-containing catalyst with an activated carbon support  
 IN Fischer, Rolf Hartmuth; Pinkos, Rolf; Schunk, Stephan Andreas; Wulff-Doering, Joachim; Stein, Frank  
 PA BASF A.-G., Germany  
 SO Ger. Offen., 6 pp.  
 CODEN: GWXXBX  
 DT Patent  
 LA German  
 IC ICM C07C029-136  
 ICS B01J023-656  
 CC 35-2 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 23, 45, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	DE 10009817	A1	20010906	DE 2000-10009817	20000301 <--
	WO 2001064338	A1	20010907	WO 2001-EP2337	20010301 <--
	W: JP, KR, US RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR				
	EP 1261423	A1	20021204	EP 2001-909811	20010301 <--
	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, FI, CY, TR				
	US 2003114719	A1	20030619	US 2002-220566	20021029 <--
PRAI	DE 2000-10009817	A	20000301 <--		
	WO 2001-EP2337	W	20010301		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
DE 10009817	ICM C07C029-136 ICS B01J023-656	
DE 10009817	ECLA B01J021/18; B01J023/656H; B01J023/89G16; C07C029/17F<--	
US 2003114719	ECLA B01J021/18; B01J023/656H; B01J023/89G16; C07C029/17F<--	
AB	Alcs. (e.g., 1,4-butanediol) are prepared by catalytic hydrogenation of carbonyl compds. (e.g., maleic acid) using a rhenium-platinum-containing catalyst with an activated carbon support which contains 0.0001-0.5% rhenium (in a weight ratio to the activated carbon), 0.0001-0.5% platinum, and, optionally, 0-0.25% of at least one of Zn, Cu, Ag, Au, Ni, Fe, Ru, Mn, Cr, Mo, W, and V, where the	

activated carbon is nonoxidatively pretreated with a nonoxidative acid (e.g., sulfuric acid) or base.

ST alc manuf carbonyl compd hydrogenation; hydrogenation catalyst alc manuf; butanediol manuf maleic acid hydrogenation

IT Carboxylic acids, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(esters; production of alcs. by the hydrogenation of)

IT Acids, processes  
RL: PEP (Physical, engineering or chemical process); PROC (Process)  
(inorg., nonoxidative; procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support pretreated with)

IT Bases, processes  
RL: PEP (Physical, engineering or chemical process); PROC (Process)  
(nonoxidative; procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support pretreated with)

IT Acids, processes  
RL: PEP (Physical, engineering or chemical process); PROC (Process)  
(organic, nonoxidative; procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support pretreated with)

IT Hydrogenation catalysts  
(procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)

IT Aldehydes, reactions

Anhydrides

Carboxylic acids, reactions

Lactones

RL: RCT (Reactant); RACT (Reactant or reagent)  
(production of alcs. by the hydrogenation of)

IT Hydrogenation  
(production of alcs. by the hydrogenation of carbonyl compds.)

IT Glycols, preparation  
RL: IMF (Industrial manufacture); PREP (Preparation)  
(production of alcs. by the hydrogenation of carbonyl compds.)

IT Alcohols, preparation  
RL: IMF (Industrial manufacture); NUU (Other use, unclassified); PREP (Preparation); USES (Uses)  
(production of alcs. by the hydrogenation of carbonyl compds.)

IT Carbonyl compounds (organic), reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(production of alcs. by the hydrogenation of carbonyl compds.)

IT 64-18-6, Formic acid, processes 64-19-7, Acetic acid, processes 1310-58-3, Potassium hydroxide, processes 1310-73-2, Sodium hydroxide, processes 1336-21-6, Ammonium hydroxide 7647-01-0, Hydrochloric acid, processes 7664-38-2, Phosphoric acid, processes

RL: PEP (Physical, engineering or chemical process); PROC (Process)  
(activated carbon nonoxidizing pretreatment agent; procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)

IT 7440-44-0, Activated carbon, uses  
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)  
(activated; procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)

IT 7439-89-6, Iron, uses 7439-96-5, Manganese, uses 7439-98-7, Molybdenum, uses 7440-02-0, Nickel, uses 7440-06-4, Platinum, uses 7440-15-5, Rhenium, uses 7440-18-8, Ruthenium, uses 7440-22-4, Silver, uses 7440-33-7, Tungsten, uses 7440-47-3, Chromium, uses 7440-50-8, Copper, uses 7440-57-5, Gold, uses 7440-62-2, Vanadium, uses 7440-66-6, Zinc, uses

RL: CAT (Catalyst use); USES (Uses)  
(procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)

IT 1314-68-7, Dirhenium heptoxide  
RL: CAT (Catalyst-use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)  
(procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)

IT 629-11-8P, 1,6-Hexanediol 118562-73-5P  
RL: IMF (Industrial manufacture); PREP (Preparation)

- (procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)
- IT 96-48-0, .gamma.-Butyrolactone 108-30-5,  
Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions  
110-15-6, Succinic acid, reactions  
110-16-7, Maleic acid, reactions  
110-17-8, Fumaric acid, reactions 124-04-9, Adipic acid,  
reactions 502-44-3, Caprolactone 1191-25-9, 6-Hydroxycaproic acid  
178804-38-1  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)
- IT 7732-18-5, Water, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(washing solvent; procedure for the production of alcs. by the hydrogenation of carbonyl compds. using rhenium-and-platinum-containing catalyst with an activated carbon support)
- L50 ANSWER 4 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
AN 2001:128171 HCAPLUS  
DN 134:164831  
ED Entered STN: 21 Feb 2001  
TI Process for hydrogenation of maleic acid to 1,4-butanediol by using oxidized carbon-supported catalysts  
IN Budge, John R.; Attig, Thomas G.; Dubbert, Robert A.  
PA The Standard Oil Company, USA  
SO Jpn. Kokai Tokkyo Koho, 30 pp.  
CODEN: JKXXAF  
DT Patent  
LA Japanese  
IC ICM B01J023-66  
ICS B01J023-89; C07B061-00; C07C029-149; C07C031-20; C07D307-08  
CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)  
Section cross-reference(s): 23, 67
- FAN.CNT 1
- | PATENT NO.          | KIND | DATE     | APPLICATION NO. | DATE         |
|---------------------|------|----------|-----------------|--------------|
| JP 2001046871       | A2   | 20010220 | JP 1999-219971  | 19990803 <-- |
| AU 772779           | B2   | 20040506 | AU 1999-43498   | 19990809 <-- |
| AU 9943498          | A1   | 20010215 |                 |              |
| PRAI JP 1999-219971 | A    | 19990803 | <--             |              |
- CLASS
- | PATENT NO.    | CLASS | PATENT FAMILY CLASSIFICATION CODES                             |
|---------------|-------|--|
| JP 2001046871 | ICM   | B01J023-66   |
|               | ICS   | B01J023-89; C07B061-00; C07C029-149; C07C031-20;<br>C07D307-08 |
- AB Maleic acid, maleic anhydride and other hydrogenatable precursors are catalytically hydrogenated into 1,4-butanediol and THF by using a hydrogenation catalyst comprising palladium, silver, rhenium, and .gtoreq.1 aluminum, and/or cobalt on a carbon support, wherein the catalyst is prepared by (i) oxidizing the carbon support with an oxidizing agent; (ii) impregnating the treated support in .gtoreq.1 impregnation step comprising contacting the support with a source of palladium, silver, rhenium, and .gtoreq.1 aluminum, and/or cobalt, resp.; (iii) drying the impregnated support to remove solvent after each impregnation; and (iv) heating the dried support. The use of the catalyst in the process give a higher yield of 1,4-butanediol with minimal formation of .gamma.-butyrolactone byproduct.
- ST butanediol THF prepn maleic anhydride hydrogenation; carbon support oxidized hydrogenation catalyst; palladium silver rhenium carbon supported catalyst; aluminum cobalt carbon supported catalyst
- IT Catalyst supports
- Hydrogenation
- Hydrogenation catalysts
- (process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)
- IT 7440-44-0, Norit RX 1.5 Extra, uses  
RL: CAT (Catalyst use); USES (Uses)  
(activated, support; process for hydrogenation of anhydrides or dicarboxylic acids to diol by using palladium, silver and rhenium on oxidized carbon supports)
- IT 7429-90-5, Aluminum, uses 7440-48-4, Cobalt, uses 7761-88-8, Silver nitrate, uses 7782-61-8, Ferric nitrate nonahydrate 10102-05-3.

Palladium nitrate 13768-11-1, Perrhenic acid  
 RL: CAT (Catalyst use); USES (Uses)  
 (process for hydrogenation of anhydrides or dicarboxylic acids to diol  
 by using palladium, silver and rhenium on oxidized carbon supports)

IT 109-99-9P, THF, preparation 110-63-4P,  
 1,4-Butanediol, preparation  
 RL: IMF (Industrial manufacture); PREP (Preparation)  
 (process for hydrogenation of anhydrides or dicarboxylic acids to diol  
 by using palladium, silver and rhenium on oxidized carbon supports)

IT 96-48-0, .gamma.-Butyrolactone 106-65-0, Dimethyl succinate 108-30-5,  
 Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions  
 110-15-6, Succinic acid, reactions  
 110-15-6D, Succinic acid, esters  
 110-16-7, Maleic acid, reactions  
 110-16-7D, Maleic acid, esters  
 110-17-8, Fumaric acid, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (process for hydrogenation of anhydrides or dicarboxylic acids to diol  
 by using palladium, silver and rhenium on oxidized carbon supports)

L50 ANSWER 5 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN

AN 1999:818952 HCPLUS

DN 132:50372

ED Entered STN: 30 Dec 1999

TI Ruthenium, rhenium, tin/carbon catalyst for hydrogenation in aqueous  
 solution and hydrogenation therewith

IN Bockrath, Richard Edmond; Campos, Daniel; Schwartz, Jo-Ann Theresa;  
 Stimek, Richard Thomas

PA E. I. Du Pont de Nemours & Co., USA

SO U.S., 10 pp.

CODEN: USXXAM

DT Patent

LA English

IC ICM C07D307-08

ICS C07D307-58; C07C027-04; C07C029-149

NCL 549508000

CC 35-2 (Chemistry of Synthetic High Polymers)

Section cross-reference(s): 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 6008384	A	19991228	US 1998-33992	19980303 <--
PRAI	US 1998-33992		19980303		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
------------	-------	------------------------------------

US 6008384	ICM	C07D307-08
	ICS	C07D307-58; C07C027-04; C07C029-149
	NCL	549508000

AB An improved two-step (dual-stage catalysis) aqueous hydrogenation process uses a novel trimetallic hydrogenation catalysts consisting essentially of highly dispersed, reduced ruthenium and rhenium metals in the presence of the third metal tin on carbon support, which is particularly useful in the second stage of the process. Such process and catalyst exhibit high conversion rates in aqueous solution hydrogenation of hydrogenatable precursors (e.g., maleic acid, succinic acid, corresponding esters, .gamma.-butyrolactone, etc.) to THF, .gamma.-butyrolactone, 1,4-butanediol and mixts. thereof wherein the relative molar ratio of 1,4-butanediol to THF products being produced can be controlled.

ST hydrogenation catalyst ruthenium rhenium tin carbon; maleic acid hydrogenation butanediol THF selectivity; succinic acid hydrogenation catalyst; butyrolactone prodn hydrogenation catalyst

IT Hydrogenation

(aqueous, two-step; of maleic and succinic acids in high conversion and controllability)

IT Hydrogenation catalysts

(ruthenium, rhenium, tin/carbon; for maleic and succinic acids in high conversion and controllability)

IT 7440-15-5, Rhenium, uses

RL: CAT (Catalyst use); USES (Uses)

(catalysts containing rhenium for hydrogenation of maleic and succinic acids)

IT 7440-18-8, Ruthenium, uses

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts containing ruthenium for hydrogenation of maleic and succinic acids)

IT 7440-31-5, Tin, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalysts containing tin for hydrogenation of maleic and succinic acids)

IT 96-48-0P, .gamma.-Butyrolactone  
 RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
 (catalysts for hydrogenation and production of)

IT 109-99-9P, THF, preparation 110-63-4P,  
 1,4-Butanediol, preparation  
 RL: IMF (Industrial manufacture); PREP (Preparation)  
 (hydrogenation catalysts for production from maleic and succinic acids)

IT 7440-44-0, Carbon, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (in catalysts for hydrogenation of maleic and succinic acids)

IT 110-15-6, Succinic acid, reactions  
 110-15-6D, Succinic acid, esters  
 110-16-7, Maleic acid, reactions  
 110-16-7D, Maleic acid, esters  
 110-17-8, Fumaric acid, reactions 110-17-8D, Fumaric acid, esters  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (ruthenium, rhodium, tin/carbon catalyst for hydrogenation with improved selectivity and yield)

RE.CNT 18 THERE ARE 18 CITED REFERENCES AVAILABLE FOR THIS RECORD

- RE
- (1) Anon; JP 05-246915 1993 HCPLUS
  - (2) Anon; JP 06-116182 1994 HCPLUS
  - (3) Anon; JP 06-157490 1994 HCPLUS
  - (4) Anon; JP 06-157491 1994 HCPLUS
  - (5) Anon; JP 06-179667 1994 HCPLUS
  - (6) Anon; JP 07-165644 1995 HCPLUS
  - (7) Anon; JP 09-59190 1997 HCPLUS
  - (8) Budge; US 5196602 1993 HCPLUS
  - (9) Griffiths; US 4659686 1987 HCPLUS
  - (10) Junichi, K; Bulletin Of The Japan Petroleum Institute 1970, V12, P89
  - (11) Keith; US 3138560 1964 HCPLUS
  - (12) Kitson; US 4985572 1991 HCPLUS
  - (13) Kitson; US 5149680 1992 HCPLUS
  - (14) Mabry; US 4550185 1985 HCPLUS
  - (15) Mabry; US 4609636 1986 HCPLUS
  - (16) Schwartz; US 5478952 1995 HCPLUS
  - (17) Stabel; US 5073650 1991 HCPLUS
  - (18) Ziemecki, S; Surface Mobility of Re2O7 in the System Re7+Pd0/y-A12O3 1986, P207 HCPLUS

L50 ANSWER 6 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1999:670143 HCPLUS  
 DN 131:272328  
 ED Entered STN: 21 Oct 1999  
 TI Process and catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol  
 IN Budge, John Raymond; Attig, Thomas George; Dubbert, Robert Allen  
 PA The Standard Oil Company, USA  
 SO U.S., 7 pp., Cont.-in-part of U.S. Ser. No. 781,945, abandoned.  
 CODEN: USXXAM  
 DT Patent  
 LA English  
 IC ICM C07D307-02  
 NCL 549508000  
 CC 35-2 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 23, 67

FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5969164	A	19991019	US 1998-56193	19980406 <--
	SG 74602	A1	20000822	SG 1997-3830	19971022 <--
	AU 9743631	A1	19980625	AU 1997-43631	19971029 <--
	AU 720496	B2	20000601		
	AT 262376	E	20040415	AT 1997-310014	19971211 <--
	JP 10192709	A2	19980728	JP 1997-347597	19971217 <--

CN 1185993	A	19980701	CN 1997-108787	19971219 <--
CN 1094791	B	20021127		
TW 415938	B	20001221	TW 1997-86119385	19971219 <--
EP 1077080	A1	20010221	EP 1999-306525	19990818 <--
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO				
SG 84543	A1	20011120	SG 1999-4399	19990908 <--
PRAI US 1996-781945	B2	19961220		<--

## CLASS

## PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES

US 5969164	ICM	C07D307-02
	NCL	549508000

AB A catalyst for the hydrogenation of maleic acid, maleic anhydride, or other hydrogenatable precursors (e.g., di-Me succinate) to 1,4-butanediol in high yield and selectivity is described which comprises palladium, silver, rhenium, and at least one of iron, aluminum, cobalt, or their mixts. all on a carbon support. The hydrogenation catalyst is prepared by first oxidizing the carbon support by contacting it with an oxidizing agent (e.g., nitric acid), followed by impregnating the oxidized support with a source of the catalytic metals, drying the impregnated support, and heating the dried support at 100-350.degree. under reducing conditions.

ST butanediol manuf maleic acid hydrogenation; hydrogenation catalyst maleic anhydride prepn butanediol

## IT Oxidation

(of a carbon support in the preparation of a hydrogenation catalyst for the conversion of maleic acid or hydrogenatable precursors into 1,4-butanediol)

## IT Hydrogenation

(of maleic acid or hydrogenatable precursors into 1,4-butanediol)

## IT Reduction

(of metal-impregnated and dried carbon support in the preparation of catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)

## IT Hydrogenation catalysts

(palladium and silver and rhenium and at least one of iron and/or aluminum and/or cobalt and/or their mixts. all on a carbon support for the conversion of maleic acid or hydrogenatable precursors into 1,4-butanediol)

IT 7429-90-5, Aluminum, uses 7439-89-6, Iron, uses 7440-05-3, Palladium, uses 7440-15-5, Rhenium, uses 7440-22-4, Silver, uses 7440-48-4, Cobalt, uses

RL: CAT (Catalyst use); USES (Uses)  
(catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)

IT 7601-90-3, Perchloric acid, reactions 7681-52-9, Sodium hypochlorite  
7697-37-2, Nitric acid, reactions 7722-84-1, Hydrogen peroxide,  
reactions 7727-54-0, Ammonium persulfate

RL: RCT (Reactant); RACT (Reactant or reagent)  
(in the preparation of catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)

IT 109-99-9P, Thf, preparation 110-63-4P,  
1,4-Butanediol, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)  
(process and catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)

IT 96-48-0, .gamma.-Butyrolactone 106-65-0, Dimethyl succinate 108-30-5,  
Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions  
110-15-6, Succinic acid, reactions  
110-15-6D, Succinic acid, esters  
110-16-7, Maleic acid, reactions  
110-16-7D, Maleic acid, esters  
110-17-8, Fumaric acid, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(process and catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)

IT 7440-44-0, Carbon, reactions

RL: CAT (Catalyst use); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)  
(support; catalysts for the hydrogenation of maleic acid or hydrogenatable precursors into 1,4-butanediol)

RE.CNT 1 THERE ARE 1 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

(1) Kitson; US 4985572 1991 HCPLUS

L50 ANSWER 7 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 1999:355604 HCAPLUS  
 DN 130:352770  
 ED Entered STN: 10 Jun 1999  
 TI Process and catalysts for the hydrogenation of maleic acid or its derivatives into 1,4-butanediol  
 IN Attig, Thomas George; Budge, John Raymond; Dubbert, Robert Allen  
 PA The Standard Oil Company, USA  
 SO Eur. Pat. Appl., 8 pp.  
 CODEN: EPXXDW  
 DT Patent  
 LA English  
 IC ICM C07C029-17  
 ICS C07C029-149  
 CC 35-2 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 23, 48, 67  
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI EP 919530	A1	19990602	EP 1998-309711	19981126 <--
EP 919530	B1	20020213		
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO				
US 6486367	B1	20021126	US 1997-980542	19971201 <--
AU 9891414	A1	19990617	AU 1998-91414	19981109 <--
AU 756102	B2	20030102		
SG 74671	A1	20000822	SG 1998-4651	19981111 <--
ES 2172865	T3	20021001	ES 1998-309711	19981126 <--
CN 1229072	A	19990922	CN 1998-125255	19981130 <--
CN 1110472	B	20030604		
MX 9810028	A	20000131	MX 1998-10028	19981130 <--
JP 11240846	A2	19990907	JP 1998-342228	19981201 <--
TW 401317	B	20000811	TW 1998-87119806	19990224 <--
ZA 9904944	A	20000207	ZA 1999-4944	19990802 <--
PRAI US 1997-980542	A	19971201		<--

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
EP 919530	ICM	C07C029-17
	ICS	C07C029-149
EP 919530	ECLA	C07C029/17F
US 6486367	ECLA	C07C029/17F

AB 1,4-Butanediol is prepared in high yield and selectivity by the hydrogenation of maleic acid and/or its hydrogenatable precursors (e.g., .gamma.-butyrolactone, fumaric acid, succinic acid, etc.) in the presence of a platinum-group metal catalyst (e.g., Pd and Re); the production and yield of 1,4-butanediol is enhanced by the addition of 20-160 ppm of iron, in the form of an iron compound (e.g., iron acetate), to the hydrogenatable precursor feed.

ST butanediol manuf maleic acid hydrogenation; hydrogenation catalyst iron additive manuf butanediol

IT Platinum-group metals

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT Hydrogenation  
 (of maleic acid or its derivs. into 1,4-butanediol)

IT Hydrogenation catalysts  
 (platinum-group metals with iron compds. for the conversion of maleic acid or its derivs. into 1,4-butanediol)

IT 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6,  
 Rhodium, uses 7440-18-8, Ruthenium, uses

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 7440-15-5, Rhenium, uses 7440-22-4, Silver, uses

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with platinum-group metals and iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 2140-52-5, Iron acetate 7439-89-6, Iron, uses 14451-00-4, Iron fumarate 31516-56-0, Maleic acid iron salt 38781-07-6, Butanoic acid, iron salt 43212-87-9, Iron succinate 72535-95-6, Iron propionate

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts with platinum-group metals for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 110-63-4P, 1,4-Butanediol,

preparation  
 RL: IMF (Industrial manufacture); PREP (Preparation)  
 (process and catalysts for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 96-48-0, .gamma.-Butyrolactone 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-15-6D, Succinic acid, di(C1-8 alkyl) esters 110-16-7, Maleic acid, reactions 110-16-7D, Maleic acid, di(C1-8 alkyl) esters 110-17-8, Fumaric acid, reactions RL: RCT (Reactant); RACT (Reactant or reagent)  
 (process and catalysts for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

IT 7440-44-0, Carbon, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (support; catalysts with platinum-group metals and iron compds. for the hydrogenation of maleic acid or its derivs. into 1,4-butanediol)

RE.CNT 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR THIS RECORD  
 RE  
 (1) Attig, T; US 4827001 A 1989 HCPLUS  
 (2) Hoechst; GB 1551741 A 1979 HCPLUS  
 (3) Kitson, M; US 5149680 A 1992 HCPLUS

L50 ANSWER 8 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1998:178175 HCPLUS  
 DN 128:197251  
 ED Entered STN: 26 Mar 1998  
 TI Catalyst for hydrogenation of carboxylic acids and manufacture thereof  
 IN Kusaka, Haruhiko; Takahashi, Yuko; Yokotake, Ichiro  
 PA Mitsubishi Chemical Industries Ltd., Japan  
 SO Jpn. Kokai Tokkyo Koho, 12 pp.  
 CODEN: JKXXAF  
 DT Patent  
 LA Japanese  
 IC ICM B01J023-62  
 ICS C07C029-157; C07D307-08; C07B061-00  
 CC 67-2 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)  
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 10071332	A2	19980317	JP 1996-193583	19960723 <--
PRAI JP 1996-169427		19960628 <--		

CLASS  
 PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES  
 -----  
 JP 10071332 ICM B01J023-62  
 ICS C07C029-157; C07D307-08; C07B061-00

AB The catalyst comprises combination of Ru and Sn, or other Group VIII elements in addition to Ru and Sn on a carbon-based support, wherein the catalyst is characterized by intensities of Ru when the catalyst is measured by using x-ray analyzer line anal. The process comprises allowing the carbon-based support such as activated char coal to react with nitric acid before adsorption of Ru and Sn on the support is carried out. The carboxylic acids may be selected from maleic anhydride, maleic acid, phthalic acid, succinic anhydride, succinic acid, and .gamma.-butyrolactone. The catalyst is designed for manufacture of 1,4-butanediol, THF, etc.

ST hydrogenation ruthenium tin catalyst; Group VIII element ruthenium tin catalyst; carbon based ruthenium tin catalyst

IT Charcoal  
 RL: CAT (Catalyst use); USES (Uses)  
 (activated; catalyst for hydrogenation of carboxylic acids from ruthenium and tin supported on carbon-based support)

IT Hydrogenation  
 Hydrogenation catalysts  
 (catalyst for hydrogenation of carboxylic acids from ruthenium and tin supported on carbon-based support)

IT 7440-18-8, Ruthenium, uses 7440-31-5, Tin, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalyst for hydrogenation of carboxylic acids from ruthenium and tin supported on carbon-based support)

IT 110-15-6, Succinic acid, reactions  
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
 (catalyst for hydrogenation of carboxylic acids from ruthenium and tin

supported on carbon-based support)  
 IT 96-48-0P, .gamma.-Butyrolactone  
 109-99-9P, preparation 110-63-4P, 1,4  
 -Butanediol, preparation  
 RL: PNU (Preparation, unclassified); PREP (Preparation)  
 (catalyst for hydrogenation of carboxylic acids from ruthenium and tin  
 supported on carbon-based support)  
 IT 7697-37-2, Nitric acid, uses  
 RL: TEM (Technical or engineered material use); USES (Uses)  
 (catalyst for hydrogenation of carboxylic acids from ruthenium and tin  
 supported on carbon-based support)

L50 ANSWER 9 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1998:85191 HCPLUS  
 DN 128:217030  
 ED Entered STN: 13 Feb 1998  
 TI Dihydrogen reduction of nitroorganics, alkenes, alkynes, and Schiff bases  
 using polymer-anchored orthometalated Schiff-base complexes of  
 palladium(II) as catalysts  
 AU Islam, S. M.; Bose, A.; Palit, B. K.; Saha, C. R.  
 CS Department of Chemistry, Indian Institute of Technology, Kharagpur,  
 721302, India  
 SO Journal of Catalysis (1998), 173(2), 268-281  
 CODEN: JCTLAS; ISSN: 0021-9517  
 PB Academic Press  
 DT Journal  
 LA English  
 CC 22-7 (Physical Organic Chemistry)  
 Section cross-reference(s): 35, 67  
 AB Complexation of Schiff bases derived from the condensation of  
 aminopolystyrene and carbonyl compds., PhCOR (R = H, CH<sub>3</sub>, C<sub>6</sub>H<sub>5</sub>) with  
 palladium(II) acetate results in the formation of acetato-bridged,  
 dinuclear orthopalladated complexes anchored to macroporous polystyrene  
 beads. Hydrogen activation of the material at 80.degree.C in DMF  
 suspension brings the reduction of coordinated azomethine group with  
 simultaneous replacement of the bridged acetate by H and DMF, producing  
 the corresponding mononuclear secondary amine complexes. The activated  
 species are highly active towards the dihydrogen reduction of aromatic nitro- and  
 carbonyl compds., alkenes, alkynes, and Schiff bases under normal pressure  
 at ambient temperature in aprotic solvents like DMF, DMSO, Et acetate, and  
 THF. The highest activity was observed with R = H in a DMF medium.  
 Similar polystyrene-based orthometalated secondary amine complexes of  
 palladium(II) prepared by alternative methods exhibit comparable catalytic  
 activities. The same specimen of the catalyst can be used repeatedly for  
 the reduction of the same or different substrates under comparable reaction  
 conditions and stored indefinitely without any loss of catalytic activity.  
 A tentative reduction mechanism has been suggested on the basis of catalyst  
 transformation, identification of the intermediates at various stages of  
 reaction, and kinetic studies.  
 ST polymer supported palladium redn catalyst; nitro org redn polymer  
 supported palladium; alkene polymer supported palladium; alkyne polymer  
 supported palladium; Schiff base polymer supported palladium  
 IT Aldehydes, reactions  
 Nitro compounds  
 RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT  
 (Reactant); PROC (Process); RACT (Reactant or reagent)  
 (aromatic; dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff  
 bases using polymer-anchored orthometalated Schiff-base complexes of  
 palladium(II) as catalysts)  
 IT Hydrogenation  
 Hydrogenation catalysts  
 Hydrogenation kinetics  
 Polymer-supported reagents  
 Substituent effects  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases  
 using polymer-anchored orthometalated Schiff-base complexes of  
 palladium(II) as catalysts)  
 IT Alkenes, reactions  
 Alkynes  
 Schiff bases  
 RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT  
 (Reactant); PROC (Process); RACT (Reactant or reagent)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases  
 using polymer-anchored orthometalated Schiff-base complexes of  
 palladium(II) as catalysts)  
 IT Aromatic compounds

- RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
 (nitro; dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 7440-05-3, Palladium, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (charcoal-supported Pd vs. polymer-supported Pd complexes; dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 196091-85-7DP, polymer-supported 196091-86-8DP, polymer-supported 196091-87-9DP, polymer-supported  
 RL: CAT (Catalyst use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 98-86-2DP, Acetophenone, reaction products with p-aminopolystyrene, palladium(II) complexes 100-44-7DP, Benzyl chloride, reaction products with p-aminopolystyrene, palladium(II) complexes 100-52-7DP, Benzaldehyde, reaction products with p-aminopolystyrene, palladium(II) complexes, preparation 119-61-9DP, Benzophenone, reaction products with p-aminopolystyrene, palladium(II) complexes 9003-53-6DP, Polystyrene, p-aminated, Schiff base reaction products, palladium(II) complexes  
 RL: CAT (Catalyst use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 78-79-5, Isoprene, reactions 86-57-7, 1-Nitronaphthalene 88-72-2, o-Nitrotoluene 88-73-3, o-Chloronitrobenzene 98-95-3, Nitrobenzene, reactions 99-65-0, m-Dinitrobenzene 99-99-0, p-Nitrotoluene 100-00-5, p-Chloronitrobenzene 100-25-4, p-Dinitrobenzene 100-52-7, Benzaldehyde, reactions 102-96-5, .omega.-Nitrostyrene 110-16-7, Maleic acid, reactions 110-17-8, Fumaric acid, reactions 110-83-8, Cyclohexene, reactions 501-65-5, Diphenylacetylene 536-74-3, Phenylacetylene 538-51-2, Benzylideneaniline 592-41-6, 1-Hexene, reactions 610-93-5, 6-Nitrophthalide 622-29-7, N-Methylbenzaldimine 26791-93-5, Methyl 4,5-dimethoxy-2-nitrobenzoate  
 RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 100-42-5P, Styrene, reactions  
 RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); PROC (Process); RACT (Reactant or reagent)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 6418-00-4P  
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); PROC (Process); RACT (Reactant or reagent)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 39963-25-2DP, polymer-supported 39963-30-9DP, polymer-supported 39963-33-2DP, polymer-supported 204200-62-4DP, polymer-supported  
 RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases using polymer-anchored orthometalated Schiff-base complexes of palladium(II) as catalysts)
- IT 62-53-3P, Aniline, preparation 78-78-4P, 2-Methylbutane 95-51-2P, o-Chloroaniline 95-53-4P, o-Toluidine, preparation 100-41-4P, Ethylbenzene, preparation 100-51-6P, Benzyl alcohol, preparation 103-29-7P, 1,2-Diphenylethane 103-32-2P, N-Phenylbenzylamine 103-67-3P, N-Methylbenzylamine 106-47-8P, p-Chloroaniline, preparation 106-49-0P, p-Toluidine, preparation 106-50-3P, p-Phenylenediamine, preparation 108-45-2P, 1,3-Benzenediamine, preparation 110-15-6P, Succinic acid, preparation 110-54-3P, Hexane, preparation 110-82-7P, Cyclohexane, preparation 134-32-7P,

1-Aminonaphthalene 6125-24-2P, .omega.-Nitroethylbenzene 26759-46-6P,  
 Methyl 2-amino-4,5-dimethoxybenzoate 57319-65-0P, 6-Aminophthalide  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (dihydrogen reduction of nitroorgs., alkenes, alkynes, and Schiff bases  
 using polymer-anchored orthometalated Schiff-base complexes of  
 palladium(II) as catalysts)

RE.CNT 57 THERE ARE 57 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

- (1) Albers, M; J Mol Catal 1985, V30, P213 HCPLUS
- (2) Aramendia, M; Appl Catal 1984, V10, P347 HCPLUS
- (3) Baralt, E; J Org Chem 1984, V49, P2626 HCPLUS
- (4) Baraniyai, I; J Mol Catal 1985, V82, P343
- (5) Blum, J; Jerusalem Symp Quantum Chem Biochem 1979, V12, P265 HCPLUS
- (6) Bose, A; Chem Indus 1987, V260
- (7) Bose, A; J Mol Catal 1989, V49, P271 HCPLUS
- (8) Brooks, E; J Chem Soc A 1966, P1241 HCPLUS
- (9) Brown, J; Tetrahedron Lett 1979, V20, P2933
- (10) Card, R; J Org Chem 1979, V44, P1095 HCPLUS
- (11) Choudary, B; J Catal 1991, V130, P41 HCPLUS
- (12) Compelo, J; J Mol Catal 1993, V85, P305
- (13) Duca, D; J Catal 1995, V154, P69 HCPLUS
- (14) Durig, J; Spectrochim Acta 1965, V21, P1367 HCPLUS
- (15) Fetscher, C; J Org Chem 1939, V71, P4
- (16) Fieser And Fieser; Reagents for Organic Synthesis, 1979, V3, P291
- (17) Gokak, D; J Mol Catal 1989, V49, P285 HCPLUS
- (18) Hartley, F; Adv Organomet Chem 1977, V15, P189 HCPLUS
- (19) Holy, N; J C S Chem Commun 1978, P1074 HCPLUS
- (20) Holy, N; J Org Chem 1979, V44, P239 HCPLUS
- (21) Holy, N; J Org Chem 1980, V45, P1418 HCPLUS
- (22) Holy, N; Tetrahedron Lett 1977, V42, P3703
- (23) Islam, M; To be published
- (24) Khandual, P; J Indian Chem Soc 1986, V63, P901 HCPLUS
- (25) King, R; J Org Chem 1979, V44, P385 HCPLUS
- (26) Kingston, J; Chem Commun 1963, P455
- (27) Knifton, J; J Org Chem 1975, V40, P519 HCPLUS
- (28) Knifton, J; J Org Chem 1976, V41, P1200 HCPLUS
- (29) Leznoff, C; Rev Chem Soc 1974, P65 HCPLUS
- (30) Li, Y; J Catal 1981, V2, P42 HCPLUS
- (31) Log, B; J Mol Catal 1993, V79, P253
- (32) Macdonald, R; J Catal 1979, V57, P195 HCPLUS
- (33) Mares, F; J Catal 1988, V112, P145 HCPLUS
- (34) Marimelli, T; J Catal 1995, V156, P51
- (35) Mukherjee, D; Indian J Chem Soc A 1992, V31, P243
- (36) Mukherjee, D; J Mol Catal 1994, V88, P57 HCPLUS
- (37) Onue, H; J Organomet Chem 1972, V43, P431
- (38) Parameswaran, V; Reaction Kinet Catal Lett 1991, V44, P185 HCPLUS
- (39) Parshall, G; Homogeneous Catalysis The application and Chemistry of  
 Catalysis by Soluble Transition Metal Complexes, 1980, P227
- (40) Saha, C; J Chem Tech Biotechnol 1987, V37, P223
- (41) Sanchez-Delgado, R; Inorg Chem 1986, V25, P1106 HCPLUS
- (42) Santra, P; Chem Indus 1984, V713
- (43) Santra, P; J Mol Catal 1987, V39, P279 HCPLUS
- (44) Shah, J; J Mol Catal 1990, V60, P141 HCPLUS
- (45) Shah, J; J Mol Catal 1990, V60, P141 HCPLUS
- (46) Silverstein, R; "IR Spectroscopy" 5th ed 1991, P124
- (47) Smith, F; Tetrahedron 1963, V19, P445
- (48) Stephenson, P; J Inorg Nucl Chem 1967, V29, P2122
- (49) Tafesh, A; Tetrahedron Lett 1995, V36, P9305 HCPLUS
- (50) Terasawa, M; J Catal 1978, V51, P406 HCPLUS
- (51) Terasawa, M; J Catal 1979, V57, P315 HCPLUS
- (52) Tijani, A; Appl Catal 1991, V76(2), P255 HCPLUS
- (53) Vogel, A; "Textbook of Practical Organic Chemistry," 5th ed 1981
- (54) Weston, A; J Am Chem Soc 1951, V73, P1381 HCPLUS
- (55) Wink, D; J Am Chem Soc 1987, V109, P436 HCPLUS
- (56) Yermakov, Y; Catal Rev 1976, V13, P77
- (57) Zuffa, J; J Am Chem Soc 1986, V108, P552 HCPLUS

L50 ANSWER 10 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1998:1355 HCPLUS  
 DN 128:63169  
 ED Entered STN: 02 Jan 1998  
 TI Catalysts for the hydrogenation of aqueous solutions of maleic acid and  
 its derivatives into 1,4-butanediol  
 IN Pedersen, S. Erik; Frye, John G., Jr.; Attig, Thomas G.; Budge, John R.  
 PA Standard Oil Co., USA  
 SO U.S., 7 pp.

CODEN: USXXAM  
 DT Patent  
 LA English  
 IC ICM C07C029-149  
 ICS C07D307-08  
 NCL 568864000  
 CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)  
 Section cross-reference(s): 23, 48, 67

## FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5698749	A	19971216	US 1995-524195	19950906 <--
	EP 881203	A1	19981202	EP 1997-303664	19970530 <--
	EP 881203	B1	20010919		
	R: AT, BE, DE, ES, FR, GB, IT, NL				
	AT 205820	E	20011015	AT 1997-303664	19970530 <--
	ES 2164992	T3	20020301	ES 1997-303664	19970530 <--
	TW 419456	B	20010121	TW 1997-86114367	19971002 <--
PRAI	US 1995-524195	A	19950906	<--	
	EP 1997-303664	A	19970530	<--	

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
US 5698749	ICM C07C029-149	
	ICS C07D307-08	
	NCL 568864000	

AB Maleic acid, maleic anhydride and its other hydrogenatable derivs. (e.g., fumaric acid, succinic acid, etc.) are catalytically hydrogenated into 1,4-butanediol with reduced formation of THF and .gamma.-butyrolactone when the hydrogenation catalyst comprises .gtoreq.1 noble metal of Group VIII and .gtoreq.1 of Re, W, or Mo on a carbon support, which support has been contacted with an oxidizing agent prior to deposition of the metals. These catalysts are prepared by: (i) oxidizing the carbon support by contacting it with an oxidizing agent (e.g., HNO<sub>3</sub>, H<sub>2</sub>O<sub>2</sub>, HClO<sub>4</sub>, etc.); (ii) impregnating the treated support in .gtoreq.1 impregnation step(s); (iii) drying; and (iv.) heating the dried, impregnated support under reducing conditions.

ST butanol prepn maleic anhydride hydrogenation; catalyst hydrogenation prepn

IT Hydrogenation catalysts  
 (Group VIII elements and Re and/or W and/or Mo on an oxidant-treated carbon support for the conversion of aqueous solns. of maleic acid and its derivs. to 1,4-butanediol)

IT Group VIII elements  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. to 1,4-butanediol)

IT Hydrogenation  
 (of aqueous solns. of maleic acid and its derivs. to 1,4-butanediol)

IT 7439-98-7, Molybdenum, uses 7440-15-5, Rhenium, uses 7440-33-7,  
 Tungsten, uses 7440-44-0, Carbon, uses  
 RL: CAT (Catalyst use); USES (Uses)  
 (process and catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. into 1,4-butanediol)

IT 110-63-4P, 1,4-Butanediol,  
 preparation  
 RL: IMF (Industrial manufacture); SPN (Synthetic preparation); PREP (Preparation)  
 (process and catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. into 1,4-butanediol)

IT 96-48-0, .gamma.-Butyrolactone 106-65-0, Dimethyl succinate 108-30-5,  
 Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions  
 110-15-6, Succinic acid, reactions  
 110-16-7, Maleic acid, reactions  
 110-17-8, Fumaric acid, reactions 7601-90-3, Perchloric acid,  
 reactions 7681-52-9, Sodium hypochlorite 7697-37-2, Nitric acid,  
 reactions 7722-84-1, Hydrogen peroxide, reactions 7727-54-0, Ammonium persulfate  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (process and catalysts for the hydrogenation of aqueous solns. of maleic acid and its derivs. into 1,4-butanediol)

L50 ANSWER 11 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1997:528934 HCPLUS

DN 127:150390

ED Entered STN: 20 Aug 1997

TI Synthesis of .gamma.-butyrolactone by the

hydrogenation of maleic anhydride and its derivatives. Catalytic properties of ruthenium complex catalysts and the effect of additives

AU He, Dehua; Zhu, Qiming; Wakasa, Noriko; Fuchikami, Takamasa

CS State Key Lab. C1 Chem. & Technology, Dep. Chem., Tsinghua Univ., Beijing, 100084, Peop. Rep. China

SO Shiyou Huagong (1997), 26(7), 425-429

CODEN: SHHUE8; ISSN: 1000-8144

PB Beijing Huagong Yanjiuyuan

DT Journal

LA Chinese

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)

Section cross-reference(s): 35, 67

AB The catalytic properties of Ru complex catalysts for the hydrogenation of maleic anhydride and its derivs. to .gamma.-butyrolactone (I) were investigated by using a portable autoclave. The effect of acid derivs. on the formation of I was studied. Ru-phosphine complex catalysts have a good activity for the formation of I. The addition of acids promotes the formation of I. Effects of solvents and reaction conditions (reaction temperature, hydrogen pressure and reaction time) was also studied.

ST ruthenium catalyst hydrogenation maleic anhydride deriv; phosphine ruthenium catalyst hydrogenation maleic anhydride; solvent hydrogenation maleic anhydride deriv

IT Hydrogenation

Hydrogenation catalysts  
(synthesis of .gamma.-butyrolactone by hydrogenation of maleic anhydride (derivs.) with Ru complex catalysts and effects of additives for catalysts on hydrogenation)

IT Solvent effect  
(synthesis of .gamma.-butyrolactone by hydrogenation of maleic anhydride (derivs.) with Ru complex catalysts and solvent effects on hydrogenation)

IT 96-48-0P, .gamma.-Butyrolactone  
RL: IMF (Industrial manufacture); PREP (Preparation)  
(synthesis of .gamma.-butyrolactone by hydrogenation of maleic anhydride (derivs.) with Ru complex catalysts and effects of additives for catalysts on hydrogenation)

IT 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions 110-16-7, Maleic acid, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(synthesis of .gamma.-butyrolactone by hydrogenation of maleic anhydride (derivs.) with Ru complex catalysts and effects of additives for catalysts on hydrogenation)

IT 75-75-2, Methanesulfonic acid 98-11-3, Benzenesulfonic acid, uses 104-15-4, p-Methylbenzenesulfonic acid, uses 998-40-3, Tributylphosphine 1303-86-2, Boron oxide, uses 1314-23-4, Zirconia, uses 1663-45-2 4731-53-7, Trioctylphosphine 7631-86-9, Silica, uses 7664-38-2, Phosphoric acid, uses 7688-25-7 10049-08-8, Ruthenium trichloride 13463-67-7, Titania, uses 14284-93-6, Tris(acetylacetato)ruthenium 14808-79-8, Sulfate ion, uses 15243-33-1, Dodecacarbonyltriruthenium 15529-49-4, Dichlorotris(triphenylphosphine)ruthenium 17440-81-2, Triethylammonium 22594-69-0, Bis(tricarbonyldichlororuthenium)  
RL: CAT (Catalyst use); USES (Uses)  
(synthesis of .gamma.-butyrolactone by hydrogenation of maleic anhydride (derivs.) with Ru complex catalysts and solvent effects on hydrogenation)

L50 ANSWER 12 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
AN 1996:658689 HCAPLUS  
DN 125:300815  
ED Entered STN: 07 Nov 1996  
TI Hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts  
IN Kusaka, Haruhiko; Inagaki, Hiroko  
PA Mitsubishi Chemical Corp., Japan  
SO Jpn. Kokai Tokkyo Koho, 8 pp.  
CODEN: JKXXAF

DT Patent  
LA Japanese  
IC ICM C07C031-20  
ICS B01J023-656; C07C029-147; C07D307-08; C07D307-33  
ICA C07B061-00  
CC 27-6 (Heterocyclic Compounds (One Hetero Atom))  
Section cross-reference(s): 45, 67

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
------------	------	------	-----------------	------

-----  
 PI JP 08217707 A2 19960827 JP 1995-52020 19950217 <--  
 PRAI JP 1995-52020 19950217 <--

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
------------	-------	------------------------------------

JP 08217707	ICM	C07C031-20
	ICS	B01J023-656; C07C029-147; C07D307-08; C07D307-33
	ICA	C07B061-00

AB Carboxylic acids are hydrogenated with catalysts prepared by supporting colloidal Group VIII noble metal ingredients and (colloidal) Re ingredients on carriers and reducing before and/or after the supporting. A mixture of PdCl<sub>2</sub> and PVP in MeOH-H<sub>2</sub>O was refluxed for 3 h, supported on activated C, calcined at 200.degree. for 2 h, and hydrogenated at 300.degree. for 2 h. Re<sub>2</sub>O<sub>7</sub> was supported on the Pd/C and hydrogenated at 300.degree. for 2 h to prepare 1% Pd-3% Re/C, which was used in hydrogenation of maleic anhydride at 240.degree. for 2 h to give THF and .gamma.-butyrolactone with 17.5 and 73.2% selectivity, resp., at 66.0% conversion.

ST maleate hydrogenation catalyst palladium rhenium; THF prepn maleate hydrogenation catalyst; butyrolactone prepn maleate hydrogenation catalyst; carboxylate hydrogenation catalyst palladium rhenium

## IT Hydrogenation

Hydrogenation catalysts  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT Group VIII elements

RL: CAT (Catalyst use); USES (Uses)  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT Carboxylic acids, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT Alcohols, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(reducing agents in catalyst preparation; hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT Polymers, uses

RL: CAT (Catalyst use); USES (Uses)  
(water-soluble, protective colloids in catalyst preparation; hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT Alcohols, uses

RL: CAT (Catalyst use); USES (Uses)  
(lower, protective colloids in catalyst preparation; hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT Colloids

(protective, in catalyst preparation; hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

IT 7439-88-5, Iridium, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-15-5, Rhenium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses

RL: CAT (Catalyst use); USES (Uses)  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT 109-99-9P, THF, preparation 110-63-4P,

1,4-Butanediol, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT 96-48-0P, .gamma.-Butyrolactone

RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride,

reactions 110-15-6, Succinic acid, reactions

110-16-7, Maleic acid, reactions

110-17-8, Fumaric acid, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

## IT 107-19-7, Propargyl alcohol 7722-84-1, Hydrogen peroxide, uses

9003-39-8, Poly(N-vinyl-2-pyrrolidone)

RL: CAT (Catalyst use); USES (Uses)

(protective colloid in catalyst preparation; hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)  
IT 50-00-0, Formaldehyde, reactions 64-18-6, Formic acid, reactions  
302-01-2, Hydrazine, reactions 1333-74-0, Hydrogen, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(reducing agent in catalyst preparation; hydrogenation of carboxylic acids with Group VIII metal-rhenium catalysts)

L50 ANSWER 13 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN

AN 1995:785396 HCPLUS

DN 123:227624

ED Entered STN: 12 Sep 1995

TI Manufacture of 1,4-butanediol and/or tetrahydrofuran

IN Hara, Yoshinori; Endo, Koetsu; Kusaka, Haruhiko

PA Mitsubishi Kagaku KK, Japan

SO Jpn. Kokai Tokkyo Koho, 5 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM C07C031-20

ICS B01J023-62; C07C029-136; C07D307-08

ICA C07B061-00

CC 23-7 (Aliphatic Compounds)

Section cross-reference(s): 27, 67

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 07165644	A2	19950627	JP 1994-255500	19941020 <--
PRAI JP 1993-265076		19931022		<--

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 07165644	ICM	C07C031-20
	ICS	B01J023-62; C07C029-136; C07D307-08
	ICA	C07B061-00

OS CASREACT 123:227624

AB Title compds. are manufactured by catalytic hydrogenation of .gtoreq.1 compound selected from maleic anhydride, maleic acid, succinic anhydride, succinic acid, and .gamma.-butyrolactone in the presence of a supported catalyst containing Sn and .gtoreq.1 of Ru, Pt, and Rh. Thus, autoclaving an aqueous solution of maleic anhydride and Ru(6.1%)-Pt(1.7%)-Sn(5%)/SiO<sub>2</sub> at 240.degree. and H pressure 100 kg/cm<sup>2</sup> gave reaction products containing THF 61.9, .gamma.-butyrolactone 13.1, and 1,4-butanediol 11.9 mol% with 98.3% conversion of the maleic anhydride.

ST butanediol manuf; THF manuf; maleic anhydride hydrogenation; succinic anhydride hydrogenation; butyrolactone hydrogenation; ruthenium platinum rhodium tin catalyst; noble metal tin hydrogenation catalyst

IT Hydrogenation  
(of maleic anhydride to butanediol and/or THF)

IT Hydrogenation catalysts  
(ruthenium-tin/silica or noble metal-tin/silica for maleic anhydride to butanediol and/or THF)

IT 7440-06-4P, Platinum, preparation

RL: CAT (Catalyst use); IMF (Industrial manufacture); SPN

(Synthetic preparation); PREP (Preparation); USES (Uses)  
(catalyst, containing ruthenium and tin, supported on silica; catalysts for hydrogenation of maleic anhydride to butanediol and/or THF)

IT 7440-18-8P, Ruthenium, preparation

RL: CAT (Catalyst use); IMF (Industrial manufacture); SPN

(Synthetic preparation); PREP (Preparation); USES (Uses)  
(catalysts, containing platinum and tin, supported on silica; catalysts for hydrogenation of maleic anhydride to butanediol and/or THF)

IT 7440-16-6P, Rhodium, preparation

RL: CAT (Catalyst use); IMF (Industrial manufacture); SPN

(Synthetic preparation); PREP (Preparation); USES (Uses)  
(catalysts, containing ruthenium and tin, supported on silica; catalysts for hydrogenation of maleic anhydride to butanediol and/or THF)

IT 7440-31-5P, Tin, preparation

RL: CAT (Catalyst use); IMF (Industrial manufacture); SPN

(Synthetic preparation); PREP (Preparation); USES (Uses)  
(catalysts, containing ruthenium or platinum or rhodium, supported on

silica; catalysts for hydrogenation of maleic anhydride to butanediol and/or THF)

IT 110-15-6, Succinic acid, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation to butanediol)

IT 96-48-0, .gamma.-Butyrolactone 108-30-5,  
Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions  
110-16-7, Maleic acid, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation to butanediol and/or THF)

IT 109-99-9P, Tetrahydrofuran, preparation  
110-63-4P, 1,4-Butanediol,  
preparation  
RL: IMF (Industrial manufacture); SPN (Synthetic  
preparation); PREP (Preparation)  
(preparation by hydrogenation of maleic anhydride)

IT 7631-86-9, Silica, uses  
RL: CAT (Catalyst use); USES (Uses)  
(supports for hydrogenation catalysts)

L50 ANSWER 14 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
AN 1995:615302 HCAPLUS

DN 123:9328

ED Entered STN: 16 Jun 1995

TI Preparation of lactone by hydrogenation of dicarboxylic acid

IN Sato, Akira; Koga, Kazuya; Myake, Takanori

PA Tosoh Corp, Japan; Sagami Chem Res

SO Jpn. Kokai Tokkyo Koho, 5 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM C07D307-33

ICS B01J031-24; C07D309-30; C07D313-00

ICA C07B061-00

CC 27-6 (Heterocyclic Compounds (One Hetero Atom))

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 07082260	A2	19950328	JP 1993-228695	19930914 <--
PRAI JP 1993-228695		19930914	<--	

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 07082260	ICM	C07D307-33
	ICS	B01J031-24; C07D309-30; C07D313-00
	ICA	C07B061-00

OS CASREACT 123:9328

AB A lactone, useful as a solvent or an intermediate for pyrrolidone and other chems., is prepared by liquid-phase homogeneous catalytic hydrogenation

of a dicarboxylic acid in the presence of a Ru catalyst and an organic diphosphine compound. The preferred dicarboxylic acid is

maleic acid and/or succinic acid and

the corresponding lactone is .gamma.-

butyrolactone. Due to the presence of an organic diphosphine compound, this process does not require complicated reaction procedures, maintains high catalyst activity, and gives a lactone in high yield. Thus,

maleic acid 116, (Ph<sub>3</sub>P)<sub>3</sub>RuCl<sub>2</sub> 2.9, Ph<sub>2</sub>P(CH<sub>2</sub>)<sub>4</sub>PPh<sub>2</sub> 2.6

mg, and 1 mL tetraglyme were placed in an autoclave and after thoroughly purging the system with H, pressurized with H at 50 kg/cm<sup>2</sup> G, and heated

with stirring at 200.degree. for 2 h to give .gamma.-butyrolactone 72.3, 1,4-butanediol

11.3, and propionic acid 2.1 mol%. Other diphosphine compds. such as Ph<sub>2</sub>P(CH<sub>2</sub>)<sub>3</sub>PPh<sub>2</sub>, (R)-(+)-2,2'-bis(diphenylphosphino)-1,1'-binaphthyl

[(R)-(+)-BINAP], 1,1'-bis(diphenylphosphino)ferrocene, and

1-[1',2-bis(diphenylphosphino)ferrocenyl]ethyl acetate were used instead of Ph<sub>2</sub>P(CH<sub>2</sub>)<sub>4</sub>PPh<sub>2</sub> to give .gamma.-butyrolactone in

73.7, 67.9, 53.2, and 57.6% yield, resp., 1,4-

butanediol 4.6, 6.7, 0.0, 0.0, and 0.0%, resp., and propionic acid

6.3, 0.3, 0.6, and 0.7%, resp.

ST lactone hydrogenation dicarboxylic acid; ruthenium hydrogenation catalyst; org diphosphine hydrogenation catalyst

IT Hydrogenation

(preparation of lactone by hydrogenation of dicarboxylic acid)

IT Hydrogenation catalysts

(ruthenium compound and organic diphosphine for preparation of lactone by hydrogenation of dicarboxylic acid)

IT 79-09-4P, Propionic acid, preparation 110-63-4P, 1,  
 4-Butanediol, preparation  
 RL: BYP (Byproduct); PREP (Preparation)  
 (preparation of lactone by hydrogenation of dicarboxylic acid in presence of  
 ruthenium compound and organic diphosphine)

IT 6737-42-4, 1,3-Bis(diphenylphosphino)propane 7688-25-7,  
 1,4-Bis(diphenylphosphino)butane 12150-46-8, 1,1'-  
 Bis(diphenylphosphino)ferrocene 15529-49-4,  
 Dichlororotris(triphenylphosphine)ruthenium 62412-57-1 76189-55-4,  
 (R)-(+)-BINAP  
 RL: CAT (Catalyst use); USES (Uses)  
 (preparation of lactone by hydrogenation of dicarboxylic acid in presence of  
 ruthenium compound and organic diphosphine)

IT 110-15-6, Succinic acid, reactions  
 110-16-7, Maleic acid, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (preparation of lactone by hydrogenation of dicarboxylic acid in presence of  
 ruthenium compound and organic diphosphine)

IT 96-48-0P, .gamma.-Butyrolactone  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of lactone by hydrogenation of dicarboxylic acid in presence of  
 ruthenium compound and organic diphosphine)

L50 ANSWER 15 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 1994:658518 HCAPLUS  
 DN 121:258518  
 ED Entered STN: 26 Nov 1994  
 TI Process of vapor phase catalytic hydrogenation of maleic anhydride to  
 gamma-butyrolactone with activated copper-zinc-alumina-  
 graphite catalyst  
 IN Taylor, Paul D.; De Thomas, Waldo; Buchanan, Donald W., Jr.  
 PA ISP Investments Inc., USA  
 SO U.S., 6 pp. Cont.-in-part of U.S. Ser. No. 521,065, abandoned.  
 CODEN: USXXAM

DT Patent  
 LA English  
 IC ICM C07D307-33  
 NCL 549325000  
 CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)  
 Section cross-reference(s): 27, 35

## FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5347021	A	19940913	US 1991-656388	19910219 <--
	CA 2080123	AA	19911017	CA 1991-2080123	19910408 <--
	WO 9116132	A1	19911031	WO 1991-US2389	19910408 <--
	W: AU, CA, JP, KR				
	RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LU, NL, SE				
	AU 9176576	A1	19911111	AU 1991-76576	19910408 <--
	AU 642250	B2	19931014		
	JP 05505975	T2	19930902	JP 1991-507658	19910408 <--
	EP 593458	A1	19940427	EP 1991-908530	19910408 <--
	EP 593458	B1	19960327		
	R: AT, BE, CH, DE, DK, ES, FR, GB, IT, LI, LU, NL, SE				
	AT 135938	E	19960415	AT 1991-908530	19910408 <--
	ES 2085992	T3	19960616	ES 1991-908530	19910408 <--
PRAI	US 1990-521065		19900416	<--	
	US 1991-656388		19910219	<--	
	WO 1991-US2389		19910408	<--	

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
US 5347021	ICM	C07D307-33
	NCL	549325000

AB The vapor phase catalytic hydrogenation of maleic anhydride to  
 gamma-butyrolactone is achieved (>95% conversion; >80%  
 selectivity) during a prolonged period of production. The process uses an  
 activated catalyst prepared by reducing a catalyst composition comprising 30-65%  
 by weight of CuO, 18-50% by weight of ZnO and 8-22% by weight of Al2O3, and  
 activating the reduced catalyst composition in hydrogen at an activation temperature  
 of at least 400.degree.C, preferably 400.degree. to 525.degree.C, and  
 optimally about 425.degree.C. The process suitably is carried out under  
 predetd. and advantageous process conditions, including a defined molar  
 ratio of hydrogen to maleic anhydride in the vapor reactant stream, a  
 selected pressure during hydrogenation, a defined feed rate space  
 velocity, a predetd. contact time, and a suitable reaction temperature

ST vapor phase hydrogenation maleic anhydride; **butyrolactone furanone dihydro**  
 IT **Hydrogenation catalysts**  
     (vapor phase hydrogenation catalysts; process vapor phase hydrogenation of maleic anhydride to **.gamma.-butyrolactone**)  
 IT **Hydrogenation**  
     (vapor phase hydrogenation; process vapor phase hydrogenation of maleic anhydride to **.gamma.-butyrolactone**)  
 IT 1314-13-2, Zinc oxide (ZnO), processes 1317-38-0, Copper oxide (CuO), processes 1344-28-1, Aluminum oxide (Al2O3), processes 7782-42-5, Graphite, processes  
 RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)  
     (copper-zinc-alumina-graphite catalyst; process vapor phase hydrogenation of maleic anhydride to **.gamma.-butyrolactone**)  
 IT 1333-74-0  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
     (hydrogenation, vapor phase hydrogenation; process vapor phase hydrogenation of maleic anhydride to **.gamma.-butyrolactone**)  
 IT 110-16-7, Maleic acid, reactions  
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
     (process vapor phase hydrogenation of maleic acid to **.gamma.-butyrolactone**)  
 IT 96-48-0P, **.gamma.-Butyrolactone**  
 RL: IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); SPN (Synthetic preparation); PREP (Preparation); PROC (Process)  
     (process vapor phase hydrogenation of maleic anhydride to **.gamma.-butyrolactone**)  
 IT 108-31-6, Maleic anhydride, reactions  
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
     (process vapor phase hydrogenation of maleic anhydride to **.gamma.-butyrolactone**)  
 IT 110-15-6, Succinic acid, reactions  
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
     (process vapor phase hydrogenation of succinic acid to **.gamma.-butyrolactone**)  
 IT 108-30-5, Succinic anhydride, reactions  
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)  
     (process vapor phase hydrogenation of succinic anhydride to **.gamma.-butyrolactone**)

L50 ANSWER 16 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 1994:457326 HCAPLUS  
 DN 121:57326  
 ED Entered STN: 06 Aug 1994  
 TI Manufacture of lactones  
 IN Fuchigami, Takamasa; Wakasa, Noriko; Ka, Tokuka; Okada, Takashi;  
     Sasakihara, Hiroyuki; Fujimura, Atsushi; Myake, Takanori; Kano, Yoshiaki;  
     Saito, Toshihiro  
 PA Tosoh Corp, Japan; Sagami Chem Res  
 SO Jpn. Kokai Tokkyo Koho, 5 pp.  
 CODEN: JKXXAF

DT Patent  
 LA Japanese  
 IC ICM C07D307-33  
     ICS B01J023-44; C07D309-30  
 ICA C07B061-00  
 CC 27-6 (Heterocyclic Compounds (One Hetero Atom))  
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 06041106	A2	19940215	JP 1992-56520	19920210 <--
PRAI JP 1992-56520		19920210		

CLASS  
 PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES  
 ----- ----- -----  
 JP 06041106 ICM C07D307-33  
     ICS B01J023-44; C07D309-30  
     ICA C07B061-00

OS CASREACT 121:57326  
 AB Lactones are manufactured by hydrogenating saturated and/or unsatd. dicarboxylic acid derivs. in the presence of supported noble metals of VIII group as catalyst and inorg. alkali metal salts and the process is applied to succinic acid and/or maleic acid derivs. to give .gamma.-butyrolactone. Thus, maleic anhydride was hydrogenated in dimethoxyethane in the presence of Pd(5%)/C and Cs<sub>2</sub>SO<sub>4</sub> at 180.degree. and H pressure 50 kg/cm<sup>2</sup> gauge for 16 h to give 97 mol% .gamma.-butyrolactone.  
 ST lactone prep; butyrolactone prep; dicarboxylate hydrogenation; noble metal catalyst; alkali metal catalyst hydrogenation dicarboxylate; succinic acid hydrogenation; maleic acid hydrogenation  
 IT Hydrogenation catalysts  
     (Group VIII metals and alkali metal salts, for dicarboxylates to lactones)  
 IT Group VIII elements  
     RL: CAT (Catalyst use); USES (Uses)  
         (catalysts, containing alkali metal salts, for hydrogenation of dicarboxylates, to lactones)  
 IT Hydrogenation  
     (of dicarboxylates, to lactones)  
 IT Lactones  
     RL: SPN (Synthetic preparation); PREP (Preparation)  
         (preparation of, by hydrogenation of dicarboxylates)  
 IT Carboxylic acids, reactions  
     RL: RCT (Reactant); RACT (Reactant or reagent)  
         (di-, hydrogenation of, lactones from)  
 IT Alkali metals, uses  
     RL: USES (Uses)  
         (salts, catalysts containing Group VIII elements and, for hydrogenation of dicarboxylates to lactones)  
 IT 7440-05-3, Palladium, uses  
     RL: CAT (Catalyst use); USES (Uses)  
         (catalyst, supported on activated carbon, containing alkali metal salts, for hydrogenation of dicarboxylates to lactones)  
 IT 10294-54-9, Cesium sulfate  
     RL: RCT (Reactant); RACT (Reactant or reagent)  
         (catalysts containing VIII group elements and, for hydrogenation of dicarboxylates to lactones)  
 IT 108-31-6, 2,5-Furandione, reactions 110-16-7, 2-  
 Butenedioic acid (Z)-, reactions  
     RL: RCT (Reactant); RACT (Reactant or reagent)  
         (hydrogenation of, .gamma.-butyrolactone from)  
 IT 1318-93-0, Montmorillonite, uses  
     RL: USES (Uses)  
         (potassium-exchanged, catalysts containing VIII group elements and, for hydrogenation of dicarboxylates to lactones)  
 IT 96-48-0P, .gamma.-Butyrolactone  
     RL: SPN (Synthetic preparation); PREP (Preparation)  
         (preparation of, by hydrogenation of maleic anhydride, VIII group elements and alkali metal salts as catalysts for)

L50 ANSWER 17 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1994:134267 HCPLUS  
 DN 120:134267  
 ED Entered STN: 19 Mar 1994  
 TI Preparation of lactones by hydrogenation  
 IN Fuchigami, Takamasa; Wakasa, Noriko; Iwai, Noriharu; Sasakihara, Hiroyuki; Okada, Takashi; Fujimura, Atsushi; Myake, Takanori; Kano, Yoshiaki; Saito, Toshihiro  
 PA Tosoh Corp, Japan; Sagami Chem Res  
 SO Jpn. Kokai Tokkyo Koho, 7 pp.  
 CODEN: JKXXAF  
 DT Patent  
 LA Japanese  
 IC ICM C07D307-33  
     ICS B01J023-40; B01J031-08  
 ICA C07B061-00  
 CC 27-6 (Heterocyclic Compounds (One Hetero Atom))  
 FAN.CNT 1  

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	-----	-----	-----	-----
PI JP 05255296	A2	19931005	JP 1992-87573	19920312 <-
PRAI JP 1992-87573		19920312	<-	

 CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 05255296	ICM ICS ICA	C07D307-33 B01J023-40; B01J031-08 C07B061-00
OS	CASREACT 120:134267	
AB	Lactones are prepared by hydrogenation of saturated and/or unsatd. dicarboxylic acid derivs., e.g. succinic acid and/or maleic acid derivs., in the presence of supported VIII metal catalysts and alkali metal-exchanged organic cation exchangers. Autoclaving a mixture of maleic anhydride, Pd/C, and K-type Amberlyst 16 in dimethoxyethane under 50 kg/cm <sup>2</sup> -gage H at 120.degree. for 16 h gave 68.7 mol% .gamma.-butyrolactone.	
ST	palladium catalyst hydrogenation maleic anhydride; succinic anhydride hydrogenation; lactone prepn; butyrolactone prepn; noble metal catalyst hydrogenation maleate; cation exchanger hydrogenation maleic anhydride	
IT	Platinum-group metals RL: CAT (Catalyst use); USES (Uses) (catalysts, supported, for hydrogenation of (un)saturated dicarboxylates, lactones from)	
IT	Alkali metals, uses RL: USES (Uses) (cation exchangers exchanged with, in hydrogenateion of (un)saturated dicarboxylates, lactones from)	
IT	Hydrogenation (of (un)saturated dicarboxylates, lactones from)	
IT	Hydrogenation catalysts (platinum-group metals, supported, for (un)saturated dicarboxylates to lactones)	
IT	Lactones RL: SPN (Synthetic preparation); PREP (Preparation) (preparation of, by hydrogenation of (un)saturated dicarboxylates)	
IT	Carboxylic acids, reactions RL: RCT (Reactant); RACT (Reactant or reagent) (di-, unsatd., hydrogenation of, lactones from, platinum group-metal catalysts for)	
IT	Polyoxalkylenes, uses RL: USES (Uses) (fluorine- and sulfo-containing, ionomers, alkali metal-exchanged, in hydrogenation of (un)saturated dicarboxylates, lactones from)	
IT	Fluoropolymers RL: RCT (Reactant); RACT (Reactant or reagent) (polyoxalkylene-, sulfo-containing, ionomers, alkali metal-exchanged, in hydrogenation of (un)saturated dicarboxylates, lactones from)	
IT	9002-29-3, ITC 50 125004-35-5, Amberlyst 16 RL: RCT (Reactant); RACT (Reactant or reagent) (alkali metal-exchanged, in hydrogenation of (un)saturated dicarboxylates, lactones from)	
IT	7440-05-3, Palladium, uses RL: CAT (Catalyst use); USES (Uses) (catalyst, supported, for hydrogenation of (un)saturated dicarboxylates, lactones from)	
IT	7440-09-7, Potassium, reactions 7440-17-7, Rubidium, reactions 7440-23-5, Sodium, reactions 7440-46-2, Cesium, reactions RL: RCT (Reactant); RACT (Reactant or reagent) (cation exchangers exchanged with, in hydrogenateion of (un)saturated dicarboxylates, lactones from)	
IT	108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride, reactions 110-15-6, Succinic acid, reactions RL: RCT (Reactant); RACT (Reactant or reagent) (hydrogenation of, butyrolactone from, platinum group-metal catalysts for)	
IT	1333-74-0 RL: RCT (Reactant); RACT (Reactant or reagent) (hydrogenation, of (un)saturated dicarboxylates, lactones from)	
IT	96-48-0P, .gamma.-Butyrolactone RL: SPN (Synthetic preparation); PREP (Preparation) (preparation of, by hydrogenation of (un)saturated dicarboxylate)	

L50 ANSWER 18 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 1993:580641 HCAPLUS  
 DN 119:180641  
 ED Entered STN: 30 Oct 1993  
 TI Preparation of lactones by hydrogenation of dicarboxylic acids  
 IN Fuchigami, Takamasa; Wakasa, Noriko; Ga, Tokuka; Sasakihara, Hiroyuki;

PA Kano, Yoshiaki; Saito, Toshihiro  
 PA Tosoh Corp, Japan; Sagami Chem Res  
 SO Jpn. Kokai Tokkyo Koho, 6 pp.  
 CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM C07D307-33  
 ICS B01J029-06

ICA C07B061-00

CC 27-6 (Heterocyclic Compounds (One Hetero Atom))

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 05148253	A2	19930615	JP 1991-337983	19911128 <--
PRAI JP 1991-337983		19911128	<--	

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 05148253	ICM	C07D307-33
	ICS	B01J029-06
	ICA	C07B061-00

OS CASREACT 119:180641  
 AB Lactones (such as .gamma.-butyrolactone) are prepared by hydrogenation of saturated and/or unsatd. dicarboxylic acids (such as succinic acid and/or maleic acid) in the presence of supported group VIII noble metal catalysts and alkali zeolites. Autoclaving a mixture of maleic acid, 5% Pd/C, Mol. Sieve 3A (K-type A zeolite), and dimethoxyethane under 50 kg/cm<sup>2</sup>-gage H at 180.degree. for 16 h gave 99% .gamma.-butyrolactone.

ST gamma butyrolactone prep; hydrogenation dicarboxylate catalyst noble metal; alkali zeolite hydrogenation dicarboxylate; lactone prep

IT Platinum-group metals

RL: CAT (Catalyst use); USES (Uses)  
 (catalysts, for hydrogenation of dicarboxylates, lactones from)

IT Hydrogenation

(of dicarboxylates, lactones from, alkali zeolites in)

IT Hydrogenation catalysts

(platinum-group metals, for dicarboxylates, lactones from)

IT Lactones

RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of dicarboxylates, catalysts and additives in)

IT Zeolites, uses

RL: USES (Uses)  
 (K mordenite-type, in hydrogenation of dicarboxylate, lactones from)

IT Zeolites, uses

RL: USES (Uses)  
 (alkali metal, in hydrogenation of dicarboxylates, lactones from)

IT Carboxylic acids, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
 (di-, hydrogenation of, lactones from, catalysts and additives in)

IT Zeolites, uses

RL: USES (Uses)  
 (ferrierite-type, in hydrogenation of dicarboxylate, lactones from)

IT 7440-05-3, Palladium, uses

RL: CAT (Catalyst use); USES (Uses)  
 (catalyst, for hydrogenation of dicarboxylates, lactones from)

IT 110-15-6, Succinic acid, reactions

110-16-7, Maleic acid, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation of, butyrolactone from, catalysts and additives in)

IT 1333-74-0

RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation, of dicarboxylates, lactones from, alkali zeolites in)

IT 96-48-0P, .gamma.-Butyrolactone

RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of maleic acid or succinic acid)

L50 ANSWER 19 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN

AN 1988:551948 HCPLUS

DN 109:151948

ED Entered STN: 28 Oct 1988

TI Catalysts and process for manufacture of butanediols and butyrolactones by hydrogenation and ring closure of dicarboxylic acids

IN Rao, Velliur Nott Mallikarjuna

PA du Pont de Nemours, E. I., and Co., USA

SO Eur. Pat. Appl., 5 pp.

CODEN: EPXXDW

DT Patent

LA English

IC ICM C07D307-32

ICS C07C029-136; C07C029-17

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)  
Section cross-reference(s): 27, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	EP 276012	A2	19880727	EP 1988-100922	19880122 <--
	EP 276012	A3	19880817		
	EP 276012	B1	19920506		
	R: DE, FR, GB, NL US 4782167	A	19881101	US 1987-6239	19870123 <--
	JP 63218636	A2	19880912	JP 1988-12430	19880122 <--
	JP 2744428	B2	19980428		
PRAI	US 1987-6239		19870123	<--	

CLASS

PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES

EP 276012	ICM	C07D307-32
	ICS	C07C029-136; C07C029-17

OS CASREACT 109:151948

AB Butyrolactones and butanediols are prepared by hydrogenating a dicarboxylic acid precursor in the presence of an aqueous reaction medium and a catalyst comprising Pd and optionally Re on a support selected from the oxides of Ti, Zr, and Hf. A solution of 5% succinic acid and 2% dioxane in water was passed at 22.4 mL/h through a fixed bed catalyst containing 4.12 g of 1% Pd and 4% Re on TiO<sub>2</sub> with 50 mL/min H flow rate. The cyclization was conducted at 200. degree./3.5 MPa, resulting in 100.00% succinic acid conversion, with selectivity to THF 1.74, .gamma.-butyrolactone 90.32, and 1,4-butanediol 7.94%.

ST butyrolactone butanediol manuf hydrogenation succinate; palladium rhenium catalyst butyrolactone manuf

IT Ring closure and formation  
(of dicarboxylic acids during hydrogenation, manufacture of butyrolactones by)

IT Hydrogenation  
(of dicarboxylic acids, butanediols and butyrolactone manufacture by)

IT Hydrogenation catalysts  
(palladium-rhenium, for manufacture of butyrolactones and butanediols from dicarboxylic acids)

IT Carboxylic acids, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(di-, hydrogenation and ring closure of, manufacture of butyrolactones and butanediols from)

IT 7440-15-5, Rhenium, uses and miscellaneous

RL: CAT (Catalyst use); USES (Uses)  
(catalysts, containing palladium, for hydrogenation and ring closure of dicarboxylic acids)

IT 7440-05-3, Palladium, uses and miscellaneous

RL: CAT (Catalyst use); USES (Uses)  
(catalysts, containing rhenium, for hydrogenation and ring closure of dicarboxylic acids)

IT 110-17-8, Fumaric acid, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation and ring closure of, butanediols and butyrolactones from)

IT 110-15-6, Succinic acid, reactions

110-16-7, Maleic acid, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation and ring closure of, butyrolactone and butanediol from, catalysts for)

IT 97-65-4, Itaconic acid, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation and ring closure of, methylbutyrolactone and methylbutanediol from, catalysts for)

IT 1333-74-0  
 RL: USES (Uses)  
 (hydrogenation, of dicarboxylic acids, butanediols and  
 butyrolactone manufacture by)  
 IT 1314-23-4, Zirconia, uses and miscellaneous 13463-67-7, Titanium  
 dioxide, uses and miscellaneous 37230-85-6  
 RL: USES (Uses)  
 (supports, for palladium and rhenium hydrogenation and ring closure  
 catalysts)

L50 ANSWER 20 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1988:55882 HCPLUS  
 DN 108:55882  
 ED Entered STN: 20 Feb 1988  
 TI Preparation of .gamma.-butyrolactone by hydrogenation  
 of maleic or succinic acid or anhydride  
 IN Wada, Hirosuke; Otake, Masayuki; Ushikubo, Takashi; Mori, Tomoyuki  
 PA Mitsubishi Chemical Industries Co., Ltd., Japan  
 SO Jpn. Kokai Tokkyo Koho, 8 pp.  
 CODEN: JKXXAF  
 DT Patent  
 LA Japanese  
 IC ICM C07D307-32  
 ICS B01J023-89  
 CC 27-7 (Heterocyclic Compounds (One Hetero Atom))  
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 62111974	A2	19870522	JP 1985-251020	19851110 <--
PRAI JP 1985-251020		19851110	<--	

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 62111974	ICM	C07D307-32
	ICS	B01J023-89

AB .gamma.-Butyrolactone (I) is prepared by hydrogenation  
 of maleic acid, succinic acid, or  
 their anhydrides in the presence of a 1-6:5-50 (weight%) Pd-Co/Kieselguhr  
 solid hydrogenation catalyst. A Pd-Co [2.1:20.8 (weight%)] catalyst  
 impregnated on powdered Kieselguhr (size >250 .mu.) (3 g) was applied to  
 hydrogenation of 30 g maleic anhydride (II) in 30 g I as a solvent at  
 80.degree. and 50 kg/cm<sup>2</sup> H for 1 h and then 250.degree. and 100 kg/cm<sup>2</sup> H  
 for 2 h to give 72.7% I based on II.

ST butyrolactone; maleic acid deriv  
 hydrogenation; succinic acid deriv hydrogenation;  
 palladium cobalt hydrogenation catalyst

IT Hydrogenation  
 (of maleic or succinic acids or anhydrides,  
 .gamma.-butyrolactone from)

IT Hydrogenation catalysts  
 (palladium-cobalt on Kieselguhr, for maleic or succinic  
 acids or anhydrides)

IT 108-30-5, Succinic anhydride, reactions 108-31-6, Maleic anhydride,  
 reactions 110-15-6, Succinic acid, reactions  
 110-16-7, Maleic acid, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation of, in presence of palladium and cobalt, .gamma.-  
 butyrolactone from)

IT 1333-74-0  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation, of maleic or succinic acids or  
 anhydrides, .gamma.-butyrolactone from)

IT 96-48-0P, .gamma.-Butyrolactone  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of maleic or succinic  
 acids or anhydrides)

L50 ANSWER 21 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1987:137661 HCPLUS  
 DN 106:137661  
 ED Entered STN: 01 May 1987  
 TI Hydrogenation of organic carbonyl compounds  
 IN Wada, Hirosuke; Shima, Kenji  
 PA Mitsubishi Chemical Industries Co., Ltd., Japan  
 SO Jpn. Kokai Tokkyo Koho, 6 pp.  
 CODEN: JKXXAF

DT Patent  
 LA Japanese  
 IC ICM C07C027-04  
 ICS B01J031-20; B01J031-24; B01J031-32; C07C029-136; C07C031-08;  
 C07C033-22; C07C069-14; C07C069-78  
 CC 21-2 (General Organic Chemistry)  
 FAN.CNT 1  
 PATENT NO. KIND DATE APPLICATION NO. DATE  
 -----  
 PI JP 61243033 A2 19861029 JP 1985-83319 19850418 <--  
 PRAI JP 1985-83319 19850418 <--  
 CLASS  
 PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES  
 -----  
 JP 61243033 ICM C07C027-04  
 ICS B01J031-20; B01J031-24; B01J031-32; C07C029-136;  
 C07C031-08; C07C033-22; C07C069-14; C07C069-78  
 AB Carboxylic acids, carboxylic anhydrides, and carboxylic esters were hydrogenated in the presence of Re (compds.) and organic amines as catalysts. Thus, 50 mmol AcOH was autoclaved 2 h in the presence of 0.1 mmol ReOCl<sub>3</sub>(PPh<sub>3</sub>)<sub>2</sub> and 1.0 mmol n-Bu<sub>3</sub>N to give 1.1% EtOH and 9.0% AcOEt.  
 ST carbonyl compd hydrogenation catalyst  
 IT Hydrogenation  
 (of carbonyl compds.)  
 IT Hydrogenation catalysts  
 (rhenium compds., for carbonyl compds.)  
 IT 141-78-6, Ethyl acetate, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (byproduct, from hydrogenation of acetic acid)  
 IT 120-51-4, Benzyl benzoate  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (byproduct, from hydrogenation of benzoic acid)  
 IT 1314-28-9, Rhenium trioxide 12060-05-8 13569-63-6 17442-18-1  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalyst, for hydrogenation of carbonyl compds.)  
 IT 64-19-7, Acetic acid, reactions 65-85-0, Benzoic acid, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation of, alc. and ester from)  
 IT 93-58-3, Methyl benzoate  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation of, benzyl alc. from)  
 IT 108-30-5, Succinic anhydride, reactions 110-15-6,  
 Succinic acid, reactions 110-16-7,  
 Maleic acid, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation of, butyrolactone and THF from)  
 IT 1333-74-0  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation, of carbonyl compds.)  
 IT 100-51-6P, Benzyl alcohol, preparation  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of Me benzoate or benzoic acid)  
 IT 64-17-5P, Ethanol, preparation  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of acetic acid)  
 IT 96-48-0P, .gamma.-Butyrolactone  
 109-99-9P, Tetrahydrofuran, preparation  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of succinic anhydride or succinic acid or maleic acid)  
 L50 ANSWER 22 OF 23 HCPLUS COPYRIGHT 2004 ACS on STN  
 AN 1980:549734 HCPLUS  
 DN 93:149734  
 ED Entered STN: 12 May 1984  
 TI Homogeneous catalytic hydrogenation of free carboxylic acids in the presence of cluster ruthenium carbonyl hydrides  
 AU Bianchi, Mario; Menchi, Gloria; Francalanci, Franco; Piacenti, Franco;  
 Matteoli, Ugo; Frediani, Piero; Botteghi, Carlo  
 CS Univ. Florence, Florence, 50121, Italy  
 SO Journal of Organometallic Chemistry (1980), 188(1), 109-19  
 CODEN: JORCAI; ISSN: 0022-328X  
 DT Journal  
 LA English  
 CC 23-16 (Aliphatic Compounds)  
 AB Saturated monocarboxylic acids up to C6, several dicarboxylic acids, and some

of the corresponding anhydrides are hydrogenated in the homogeneous phase over H4Ru4(CO)8(PBu3)4 to give the corresponding alcs. (present among the reaction products as esters) or lactones at 100-200.degree./ 100-200 atm H. Anhydrides react at temps. lower than those needed for acids. Esters are not reduced. Only .delta.-valerolactone is hydrogenated to 1,5-pentanediol. Ru carbonyl carboxylates recovered at the end of the reaction, are catalytically active intermediates.

ST carboxylic acid hydrogenation ruthenium; anhydride hydrogenation ruthenium carbonyl

IT Anhydrides  
Carboxylic acids, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation of, ruthenium carbonyl hydride catalysts for)

IT Hydrogenation  
(of carboxylic acids, alcs. and lactones from)

IT Hydrogenation catalysts  
(ruthenium carbonyl hydride, for carboxylic acids and anhydrides)

IT Carbynols  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(ruthenium hydrides, catalysts, for hydrogenation of carboxylic acids and anhydrides)

IT 141-82-2, reactions 144-62-7, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(attempted hydrogenation of)

IT 34742-78-4  
RL: CAT (Catalyst use); USES (Uses)  
(catalyst, for hydrogenation of carboxylic acid)

IT 34742-81-9 65899-42-5  
RL: CAT (Catalyst use); USES (Uses)  
(catalyst, for hydrogenation of cyclohexanone)

IT 34742-77-3  
RL: CAT (Catalyst use); USES (Uses)  
(catalyst, for hydrogenation of cyclohexanone or acetic acid)

IT 34438-91-0  
RL: CAT (Catalyst use); USES (Uses)  
(catalyst, for hydrogenation of cyclohexene or cyclohexanone)

IT 34802-75-0  
RL: CAT (Catalyst use); USES (Uses)  
(catalyst, for hydrogenation of cyclohexene, cyclohexanone or acetic acid)

IT 64-18-6, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(decomposition of, in presence of ruthenium carbonyl hydride catalyst)

IT 65-85-0, reactions 85-44-9 88-99-3, reactions 103-82-2, reactions  
106-31-0 107-92-6, reactions 110-17-8, reactions 124-04-9,  
reactions 1121-34-2 1724-02-3 6915-15-7  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation of, in presence of ruthenium carbonyl hydride catalyst)

IT 64-19-7, reactions 79-09-4, reactions 79-31-2 107-92-6, reactions  
108-24-7 108-30-5, reactions 108-94-1, reactions 109-52-4, reactions  
110-15-6, reactions 110-83-8, reactions 116-53-0 123-62-6  
142-62-1, reactions 498-21-5 503-74-2  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(hydrogenation of, ruthenium carbonyl hydride catalyst for)

IT 694-54-2P  
RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT  
(Reactant or reagent)  
(preparation and hydrogenation of)

IT 78-83-1P, preparation  
RL: SPN (Synthetic preparation); PREP (Preparation)  
(preparation of)

IT 105-60-2P, preparation  
RL: SPN (Synthetic preparation); PREP (Preparation)  
(preparation of, by hydrogenation of adipic acid in presence of ruthenium carbonyl hydride catalyst)

IT 60-12-8P 100-51-6P, preparation 102-20-5P  
RL: SPN (Synthetic preparation); PREP (Preparation)  
(preparation of, by hydrogenation of carboxylic acid)

IT 64-17-5P, preparation 71-23-8P, preparation 71-36-3P, preparation  
96-48-0P 97-85-8P 106-36-5P 109-21-7P 141-78-6P,  
preparation 659-70-1P 1679-47-6P 1679-49-8P 2173-56-0P  
2445-78-5P 6378-65-0P  
RL: SPN (Synthetic preparation); PREP (Preparation)  
(preparation of, by hydrogenation of carboxylic acid in presence of ruthenium carbonyl hydride catalyst)

IT 111-29-5P 542-28-9P 74962-45-1P

RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of glutaric acid in presence of ruthenium carbonyl hydride catalyst)

IT 87-41-2P  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (preparation of, by hydrogenation of phthalic acid anhydride in presence of ruthenium carbonyl hydride catalyst)

L50 ANSWER 23 OF 23 HCAPLUS COPYRIGHT 2004 ACS on STN  
 AN 1970:470210 HCAPLUS  
 DN 73:70210  
 ED Entered STN: 12 May 1984  
 TI Hydrogenation of maleic anhydride and intermediates by nickel-rhenium catalyst supported on kieselguhr  
 AU Kanetaka, Junichi; Kiryu, Seiichi; Asano, Taisuke; Masamune, Shinobu  
 CS Cent. Res. Lab., Mitsubishi Petrochem. Co. Ltd., Ibaragi, Japan  
 SO Bulletin of the Japan Petroleum Institute (1970), 12, 89-96  
 CODEN: BUJPAS; ISSN: 0582-4656  
 DT Journal  
 LA English  
 CC 67 (Catalysis and Reaction Kinetics)  
 AB A kinetic study of the hydrogenation of maleic anhydride and intermediates in which a Ni-Re catalyst supported on kieselguhr was used has been carried out in order to investigate the activity of this catalyst on each reaction step and its effect on the reaction mechanism. This catalyst not only resists corrosion by the organic acids such as maleic acid, succinic acid, propionic acid, and butyric acid under the co-existence of water, but also directly promotes hydrogenation of maleic anhydride to THF. The kinetic studies were done for each of the reaction steps involved in this process, and the orders and the rate of consts. of these reaction steps were obtained. Especially, from the kinetic study of hydrogenation of succinic anhydride to gamma.-butyrolactone it is clearly noted that succinic acid and water are the strong inhibitors. There are three main reaction paths in this process as follows: via . gamma.-butyrolactone > via polyester .mchgt. via succinic acid.  
 ST maleic anhydride hydrogenation catalysis; hydrogenation maleic anhydride catalysis; nickel rhenium catalyst; rhenium nickel catalyst; kieselguhr catalyst support; THF prodn catalysis  
 IT Kieselguhr  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalysts, for hydrogenation of maleic anhydride to tetrahydrofuran)  
 IT Hydrogenation catalysts  
 (nickel-rhenium, for maleic anhydride in tetrahydrofuran manufacture)  
 IT Kinetics of hydrogenation  
 (of maleic anhydride and intermediates, in preparation of tetrahydrofuran)  
 IT Activation energy of hydrogenation  
 (of maleic anhydride and intermediates, on nickel-rhenium catalysts)  
 IT Hydrogenation  
 (of maleic anhydride, to tetrahydrofuran)  
 IT 7440-02-0, uses and miscellaneous 7440-15-5, uses and miscellaneous  
 RL: CAT (Catalyst use); USES (Uses)  
 (catalysts, for hydrogenation of maleic anhydride to tetrahydrofuran)  
 IT 109-99-9P, preparation  
 RL: PREP (Preparation)  
 (from maleic anhydride, catalysts for)  
 IT 25777-14-4  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrocracking of, in catalytic formation of tetrahydrofuran)  
 IT 96-48-0 108-30-5 108-31-6, reactions 110-15-6,  
 reactions 110-63-4, reactions  
 RL: RCT (Reactant); RACT (Reactant or reagent)  
 (hydrogenation of, catalysts for)  
 IT 26247-20-1P  
 RL: PREP (Preparation)  
 (preparation of)

=> b home  
 FILE 'HOME' ENTERED AT 12:22:31 ON 18 NOV 2004